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XUM

THE

JOURNAL OF SCIENCE.

DECEMBER, 1882.

I. LITERATURE *versus* SCIENCE.

THE external or foreign relations of Science are not at present free from tension. The religious world still looks upon her position and her claims with distrust. Politicians begrudge her the share of attention which she receives from the public, as calculated to lessen the interest in agitations and "movements." Zoo-folly and Bestiarianism seek to arrest her further development in one of the most important directions. Last, but not least, Literature views her with a dislike and a jealousy which cannot be concealed. We have frequently met with expressions of this dislike on the part of historians, poets, and the like, and we have occasionally quoted such outbreaks in the "Journal of Science." Some of our readers will, perhaps, remember that a Mr. E. R. Russell, in a paper read before the Literary and Philosophical Society of Liverpool, took occasion to characterise Science as "blind and groping physicism." Sayings equally uncomplimentary might be cited from Carlyle, Ruskin, and other eminent modern writers. But the feelings of the professed literary world towards Science have been latterly expounded with much clearness and force in the "Rede Lecture" delivered before the University of Cambridge. The lecturer, Mr. Matthew Arnold, is well known as a powerful, brilliant, and admired writer. We can cheerfully admit that he has put before the English public certain lessons which, be they accepted or not, are of no small value. But as regards the question at issue we are bound to submit that he has utterly misapprehended, and consequently misrepresented, the position, the scope, and the aims of Science.

Mr. Arnold says that ten years ago he "could not help being moved with a desire to plead with the friends of physical science on behalf of letters." These very words reveal one of his cardinal mistakes. He might as well plead with the Poles on behalf of Russia, or, going back a few years, he might as rationally have pleaded with the Italians on the part of Austria, or with the Abolitionists of New England in favour of the Slave system! The question lies in a nutshell: Science is fighting for liberty, Literature for dominion. We have been living in a state of bondage which even yet is far from having come to a complete end. In how many schools is Science placed upon anything approaching to an equality with classical studies? In which of our universities can a man devote his whole time and energies to the knowledge of Nature? In Mr. Arnold's own University, Oxford, the student whose aim in life is to qualify himself for research—*e.g.*, in biology—has first to pass "Responsions and Classical Moderations," which will take up his attention for a year. When the Yorkshire College was instituted it was, indeed, first planned and named as the "Yorkshire College of Science"—whereupon there arose a loud clamour from those whom Prof. Huxley happily designates as the "Levites of culture." A college for Science alone was, they cried out, a "one-legged affair"; Literature must be added! Strange that they never felt or saw any "one-leggedness" in the many schools and colleges where, till lately at least, Science was totally excluded! In the case of the Yorkshire College the friends of Science yielded. And it was not until Sir Josiah Mason's munificent endowment, in Birmingham, that we have been able to point to at least one institution where those who desire to study Science alone may find themselves at home.* To the foundation of this College and to Prof. Huxley's inaugural speech we owe Mr. Arnold's counter-demonstration at Cambridge.

But we need not enlarge further upon the position of inferiority and restriction in which we find ourselves placed, and which Mr. Arnold naïvely "pleads" with us to accept and endure! Let him plead never so eloquently and subtly we cannot accept it without being false to ourselves, to the world, and to our duty. We claim for Science full freedom, and an equality with "letters" in all educational institutions. This demand involves that classical knowledge shall not be demanded from the student of Science at any point

* Sad that this College should in one direction have barred the door against research.

of his career, and that in examinations for scientific degrees and honours it shall not be introduced even as an optional subject. But we do not demand the abolition or restriction of literary pursuits. The "poor humanist," as Mr. Arnold calls himself and his fellow-believers collectively, may, as far as our wishes and aims are concerned, go on for ever pondering on "longs and shorts," writing "nonsense-verses" at school, and commenting on Homer and Sophocles in after life. Nor would we force our pursuits upon him. The world is wide enough for us both; let him go his way, and we will go ours. But let him remember that we cannot, dare not, tolerate his assumptions of superiority.

What is the nature of Mr. Arnold's plea on behalf of that predominance for which he is contending? He tries to show that Literature includes Science. "Literature," he says, "is a large word; it may mean everything written with letters or printed in a book. Euclid's 'Elements' and Newton's 'Principia' are thus literature. All knowledge that reaches us through books is literature." But this is not the sense in which "literature" is understood either by the friends or the opponents of its past educational supremacy. It is not the sense in which it is used by Mr. Arnold himself in the very lecture before us. For he says—"My own studies have been almost wholly in letters [a synonym for literature], and my visits to the field of the natural sciences have been very slight and inadequate." Here, in fact, he admits the distinction which he has just been calling in question. That distinction is, indeed, felt by all educated men, however little they may be able to point out the basis upon which it rests. No one would rank the "Elements" of Euclid, or the "Physics" of Aristoteles, among Greek literature in the same sense as he would the writings of Homer, of Thucidydes, or of Plato. No one in a dissertation on the characteristics of English literature would take into consideration either the "Principia" (which, by the way, was written in Latin) or the "Origin of Species." The value of these two works lies not in themselves, but in the facts which they communicate, and in the conclusions they draw from these facts. Were every copy of the "Principia" or of the "Origin of Species" destroyed, Science would be no loser, since their teachings have been incorporated into an ever-growing body of truth. But with what are commonly and properly called literary works the case is totally different. The value of the "Paradise Lost" or of "Hamlet" is not absorbed and incorporated, but remains in themselves, and hence their destruction would be a permanent loss to

literature. But there is another great distinction between Science and Literature which Mr. Arnold has overlooked: Science, if learned at all, is learned not so much from books as from things. By it, and by it alone, we learn the art of observing things and of understanding their mutual relations. Hence the distinction between Science and Literature is world-wide: they are in some respects incommensurable, and any attempt on the part of the latter to dominate or to include the former must lead not merely to hostility, but to results disastrous for the individual and the race. Nay, if a claim for supremacy and inclusion is allowable at all, it might be more rationally inverted. If we wish to know nations and their languages, even the idolised Greek tongue, we shall do well to reflect that such knowledge is but a very subordinate portion of ethnology, which is a portion of anthropology, which is a mere fragment of biology! It is interesting for the biologist to look down and see such a presumptuous mutiny in a corner of his domain,—a parish aspiring to comprehend and exercise supremacy over the affairs of an empire!

The literary opponents of Science speak much of human nature and its wants. But man can be rightly studied only in connection with the organic world of which he is a member, and with the earth upon which he lives. This Science does at least approximately; "letters" cannot even make the attempt.

Mr. Arnold puts forward with some iteration, but hardly, we venture to say, with sufficient clearness, a consideration which he thinks explains "the strength of the hold which letters have upon us." He says—"We acquire pieces of knowledge, and presently, in the generality of men, there arises the desire to relate these pieces of knowledge to our sense for conduct, to our sense for beauty, and there are weariness and dissatisfaction if the desire is baulked."

Or again:—"We feel, as we go on learning and knowing, the vast majority of mankind feel the need of relating what we have learned and known to the sense which we have in us for conduct, to the sense which we have in us for beauty."

These phrases, "sense for conduct" and "sense for beauty," are the burden of Mr. Arnold's song. They recur again and again, as do the words "sweetness and light" in some of his former writings, Now a clever catch-word may possibly overturn a throne, but it cannot decide a philosophic question.

Here Mr. Arnold falls into a sin of omission. Any new

piece of knowledge men desire, in the first place, to correlate with their necessities. This will be so as long as "nineteen-twentieths of mankind have to ask—not 'How shall we live?' but 'Can we live at all?'" This, Dr. Beard tells us, is the case in Ameriea; and in Europe, in face of the continual stream of emigrants from it to the United States, human condition cannot be supposed better. Now certainly to these nineteen-twentieths Literature has nothing to offer: she never has made two blades of grass grow where one grew before, and she never can or will in the future: she never slew a fever-germ or a noxious insect,—never warned us of an approaching tempest.

If we turn from the many to the favoured few who have time to ask "How we shall live?" we find Mr. Arnold is guilty of another omission. There is in man a sense for truth, quite as strong as the "sense for conduct and the sense for beauty," of which the lecturer makes such frequent mention. To this sense we naturally and instinctively relate every new piece of knowledge which we acquire. Is it true? If true, what is its place in the knowledge which we already possess? What can we further infer from it? What theories does it confirm or infirm? These are the questions which we naturally ask. Men as a body do not seek to correlate any scientific knowledge they may acquire with their "sense for conduct." Their "conduct," if we are to understand by that their habits and character from a moral point of view, is for the most part determined by heredity, by early training, by the example of friends and neighbours, by the presence of public opinion, and is not influenced by the state of their scientific attainments. Suppose that to-morrow half the so-called elements of chemistry were to be resolved into still simpler bodies, would anyone seriously set out on the wild-goose chase of seeking to correlate this result with ethical principles? That both ethics and æsthetics may perhaps be found to have their root in biology is possible, but "letters" certainly will not be the finder. It is doubtless true that the love of knowledge for its own sake is not the ruling passion with the majority of mankind; the many love it, if at all, for its utilities. But if Science is to a great number of people wearying and unsatisfying, does not this depend in many cases on the nature of their education, which appeals more to the passions and the emotions than to the intellect?

Mr. Arnold, after mentioning Darwin as one for whose mental cravings "Science and the domestic affections were enough," remarks—"But then Darwins are very rare.

Another great and admirable master of natural knowledge, Faraday, was a Sandemannian. *That is to say, he related his knowledge to his instinct for conduct and to his instinct for beauty by the aid of that respectable Scottish sectary Robert Sandemann.*" Now the assertion conveyed in the sentence we have italicised must be distinctly denied. Faraday was a Sandemannian, and he was an illustrious man of Science. But between his Sandemannianism and his marvellous discoveries in electricity there was no relation beyond coexistence. Indeed, unless our memory has greatly deceived us, Faraday declared, almost *totidem verbis*, that he had never sought to bring his scientific attainments into correlation with his religious faith. Either might have existed without the other.

It would almost seem as if Mr. Arnold fears a decline, ethical and æsthetical, if literature—and especially Greek literature—is deposed from its usurped position in our educational establishments. This may seem strange if we remember that the morals of that part of the nation which is void of every tincture of classical learning are at least as pure as those of the "poor humanist." If the teachings of the Greek philosophers are worn-out garments which have fallen off from the expanding form of truth, the lays of their contemporary poets are equally unfit for the youth of the present day.

Nor is it otherwise with our sense for beauty. Has it never struck Mr. Arnold that in England, the very country where classical studies have been most predominant, the love of the beautiful is feeblest? Symmetry? We may find it brighter and purer in crystals and shells, in flowers and insects, than in Greek grammars. Those who have never studied the Greek language, and those who have gladly thrown it aside as an encumbrance, can see the meanness of our modern street architecture without looking through the dim lens of classical antiquity. Neither for the right guidance of our actions nor that we may have a love for the beautiful do we need the aids of Greece and Rome. They and their humane letters cannot—simply cannot—"establish a relation between the new conceptions and our instinct for beauty, our instinct for conduct." In as far as such relations are conceivable they will be evolved to suit the changed conditions.

Mr. Arnold even endeavours to defend mediæval education against the just scorn of Prof. Huxley. As his defence ends with the usual refrain it may be left to the imagination of the reader.

One passage, however, we must still quote. Says Mr. Arnold:—"I have in my mind's eye a Member of Parliament who goes to America, who relates his travels, and who shows a really masterly knowledge of the geology of the country and of its mining capabilities, but who ends by gravely suggesting that the United States should borrow a prince from our royal family, and should make him their king, and should create a House of Lords of great landed proprietors after the pattern of ours; and then America, he thinks, would have her future happily secured. Surely, in this case, the President of the Section for Mechanical Science would himself hardly say that our Member of Parliament, by concentrating himself upon geology and mining, and so on, and not attending to literature and history, had 'chosen the more useful alternative.'"

To this facetious apologue we reply by reminding Mr. Arnold of a certain English official, well versed in literature and history, who sent out a supply of Thames water for the use of a flotilla which we had upon Lake Erie, some seventy years ago, and who, further, when the war was over, ordered the said flotilla to sail home—down the Falls of Niagara—to be paid off at Portsmouth. The error of this official—a serious and embarrassing one—springs directly from his lack of natural knowledge. On the other hand, the error of the Member of Parliament, in itself a harmless blunder, of no consequence, would not necessarily have been obviated by classical and historical studies.

Mr. Arnold may believe that he has made a satisfactory reply to Prof. Huxley. We can merely regard him as an able advocate doing his best for a thoroughly bad cause. If he is pleading with the friends of physical science the verdict cannot be in his favour.

II. A THEORY AS TO THE ORIGIN OF THE SOLAR SYSTEM.

By R. LAMONT.

IN the beginning "the earth was without form and void," or, in other words, there was matter but no motion. To this *dead* matter motion was *given*, when it immediately became as it were a thing of life; atom whirled round atom, and, as the outcome of the action of motion upon matter is attraction, atom clung to atom, and molecule rushed towards molecule, to form the nuclei of future worlds. Everywhere these nuclei went spinning round, forming vast whirlpools* in their efforts to gather up as much matter as their fellows, but, owing to difference of speed and proximity of material, all were not alike successful. There were some tiny masses furiously whirling away, in their vain endeavours to overtake their more bulky companions, who had already swept up everything within their reach, and were now striving to draw their little friends within their grasp, but, owing to these smaller masses being endowed with a rotary motion round their own axis, the only effect which the attraction of the larger masses had on them was to convert part of their rotary motion into centrifugal force, which conversion had not only the effect of balancing the attraction, but also of swinging the satellites into the same plane as their primaries.

While this was going on among the comparatively smaller bodies, in our own system there was one huge mass which had already sucked all the surrounding matter within its mighty vortex, and was now seeking to bring these rival systems within its powerful influence; but, as satellite was rolling round planet, and planet was spinning round on its axis, it had no longer to deal with the infinitely small particles of which it had just been built up, but with masses composed of the same material and endowed with the same motion as the Sun himself. He tried to draw them in, but as his attraction diminished with distance, and as the bodies on which he was exerting his attractive power possessed considerable magnitude, the attraction was much greater on

* *See* Spiral Nebula in Canes Venatici.

the near than on the further side of each individual planet; the effect of this, combined with their rotation, being to cause them to fly off at right angles to the attracting power, but still held by the attractive influence they were swung to the same plane, and rolled round the sun as a centre.

If the whole had ended here, and the planets been destitute of the power to increase or diminish the sun's attraction, the retarding influence of such attraction would have gradually overcome centrifugal force, and the planets would have been gently swept on to his surface, the whole matter of the Universe thus ultimately coalescing into one monster mass, which, being no longer acted on by external matter, would have eventually returned to that void from which it sprang. But such was not the case; each planet, as it was added to our system, increased the sun's attraction, enabling him to stretch his influence still further out, and bring within his sway the more distant worlds. Attraction was increased, but so was motion; the fight between attraction and centrifugal force began, the core of our huge dynamo-machine became covered with a brilliant shroud, and the Sun shone out in all his splendour, radiating his light in every direction, as it were in payment of the force expended to maintaim him in his glory.

Along with these formations and arrangements of new worlds there were at the same time small bodies, which, at the balancing of the more important masses, were situated midway between two contending powers, one of which for a time got them within its influence. Their speed, at first slow, gradually went on increasing as they got nearer to the attracting body; and as they were almost destitute of centrifugal force, owing to their having two centres of revolution, they appeared to be driving right on to the surface of the sun. Faster and faster they rushed along, until it almost seemed as if the puny masses were destined to overturn the equipoise of our system. But a sudden change took place; the comets had reached the region of contending forces, attraction was immediately changed into repulsion, and they swept round their huge relation uninjured by his power. Out into space they went, throwing off their bright trappings as they neared their starting-points, there to set out on a new pilgrimage, through other systems and round other suns.

The chief use of the comets in the celestial mechanism is to hold system unchangeably separated from system, so that the motion of the one shall not in any way interfere with the correct working of the other. If some kind of stay had not been provided all would have been confusion; system

would have contended with system, and planet with sun. But there is none of this. Far out in the confines of space we find the same regularity and completeness as in our own system, even these anomalous bodies, the variable stars, with their ever-changing brilliancy, being but the product of this action of motion upon matter.

III. DOMESTICITY IN ANIMALS.

AMONG the questions for which the naturalist is expected to have a stock of answers neatly cut and dried, one of the most frequent relates to the domesticity of animals. Why, it is asked, has man succeeded in taming certain species and not others? The querist is not always satisfied to be told that such animals as are likely to be useful to man have for the most part been brought to take their place in human civilisation, whilst those which were dangerous or useless have been left outside, and are treated as enemies. He may, on further reflection, ask why the aborigines of the western hemisphere, at the time of its first discovery by the Spaniards, seem to have had no domestic animals at all, whilst nations of the eastern continent not further advanced in civilisation had enjoyed the services of beasts of burden from a date far anterior to the dawn of history. There is perhaps no feature in the institutions of the ancient Mexican empire more startling than this: that the tasks which in the Old World fell to the lot of the ox, the horse, the ass, or the camel, there devolved upon human beings. A peculiar caste of men, trained to the task and doubtless possessing hereditary powers of speed and indurance, carried intelligence between different parts of the empire. Another caste, the Tamemes of the early Spanish explorers and conquerors, bore merchandise upon their shoulders.

The ancient Peruvians had one only domestic animal, the Llama, adapted by its habits and constitution merely to mountainous countries.

The followers of Swainson seek to explain such anomalies in a somewhat peculiar manner. They argue that all

animals capable of domestication belong to their so-called "Rasorial type." Swainson himself writes:—"It seems to have been ordained by Almighty Wisdom that there should be one type above all others whose powers were to be more especially devoted to man, and which should evince an aptitude and a disposition to submit to his dominion far above all other created things. This is the grand characteristic of all rasorial types among the more perfectly formed vertebrate animals, whose size or structure are in any way adapted to answer the end proposed. . . . The ungulated quadrupeds (*Ungulata*) and the rasorial order of birds which show the highest intelligence, the greatest docility, and the most cheerful contentment under the domestication of man. . . . All our quadrupeds of burden or of food are taken from the *Ungulata*. . . . The dog is a rasorial type of the *Feræ*. . . . The common duck, though a natatorial bird, is yet the rasorial type of its own family. . . . The hymenopterous order of the winged insects is, in its own circle, a rasorial type, and we thus find that the ants (?) and the bees, the most useful insects to man and the most intelligent and social of annulose animals represent the ruminating quadrupeds and the gallinaceous birds."*

We are thus to learn that certain animals have been divinely pre-ordained for domestication. These, accordingly, man has succeeded in taming, whilst if he has attempted the subjugation of any other species he has failed.

We will not in reply call in question Swainson's entire classification of animals, built as it is upon outward structure only, and with an avowed disregard of internal anatomy and of embryology. Such a criticism would take us too far, and would in these days be a mere re-slaying of the slain. On this point we will merely remark that it was perfectly easy for Mr. Swainson, by his representative system, to refer a species to any type or "circle" which happened to be convenient.

We will in our reply adhere to plain facts. If the Rasores and their representatives have been especially adapted for domestication, why do so many of them remain outside the pale? We may take as an instance the common pheasant and certain allied species. These birds undoubtedly belong to the order *Rasores*, and even to the same family which includes the common fowl. The delicacy of their flesh has been a strong inducement to man to reduce them to com-

* W. Swainson. Geography and Classification of Animals (in Lardner's Cabinet Cyclopædia), p. 258.

plete domestication, so that they could be bred in the poultry-yard without the costly formalities of "preserves" and game-keepers. But no! So far they still remain half wild; and though they may show some attachment to the person who feeds them, yet on the approach of a stranger they show none of the confidence of the domestic fowl, but at once flee for shelter to the nearest thicket.

Here then we see that human effort, under strong inducement, has failed to domesticate a bird nearly allied to our ordinary poultry! What may take place in the course of successive generations cannot be foreseen.

Turning again to America, we may ask why none of its aborigines had succeeded in domesticating the turkey? With us, and with the white settlers across the Atlantic, it has proved itself quite susceptible of tameness. Were not the Mexicans sufficiently civilised to make so natural an attempt?

Further, why was the American bison (erroneously called buffalo) never brought into subjection by the Red Indians? It would have been of great service to them as a beast of burden as well as for food. It is unquestionably a member of the *Ungulata*, a ruminant animal, and thus belongs to the above-mentioned "rasorial" type. Mr. Swainson, who always can find a way of escape, says:—"Let us first look to that (the genus) of *Bos*, where we have the ox and the bison actually following each other in close affinity, and yet no two animals in their moral character can be more opposite: the one is the most useful, docile, and tameable of the brute creation, the other wild, revengeful, and showing an innate detestation of man. The ox is the typical example of the genus, the bison is the sub-typical." Hence we are to believe that the Red Indians did not tame the bison because he is untameable.

Mr. Swainson is here, as not unfrequently, at issue with facts. The bison, even when wild, shows no disposition to attack man unless molested. He is, indeed, far less dangerous than the half-wild cattle of Texas, of the Andean Paramos, or of the Falkland Islands. The "docility" of *Bos taurus* is, indeed, confined to the female sex. To an unarmed man in an open country there are few animals more dangerous than the common bull; and if he is above four years of age, he is exceedingly given to indulge in unprovoked attacks.*

* The pugnacity of the bull was no doubt useful when he had to defend his family against wolves. But in a country like England it is surely the duty of cattle-breeders to attempt the development of a more peaceful strain.

But to complete Mr. Swainson's discomfiture, the bison has been found and reported by the most eminent authorities in America to be readily susceptible of domestication.* There is little inducement to multiply the tame breed on the large scale as the cows are not good milkers. But in the absence of ordinary cattle they would be of great value. It must, therefore, remain a problem why the Red Indians did not have herds of tame bison just as the Tartars of the Asiatic steppes have their oxen. The fault evidently lay with them rather than with the bison.

Mr. Swainson's rule concerning the pre-ordained capability of certain animals for tameness breaks down in another direction. Of the carnivorous animals which enter into general domestication, viz., the dog and the cat, he pronounces the former to be the rasorial type of the carnivorous circle. But he does not venture to refer to the cat. This animal is assuredly one of the typical forms of the Carnivora, and hence according to theory, it should be hostile to man. Yet no creature show a greater craving for human sympathy. This is the more remarkable as it is not a gregarious or social species, and even in a state of tameness shows no marked liking for the companionship of its own kind. Two mature cats of the same sex seldom meet each other without muttering an execration. How strikingly different is this from the behaviour of dogs among themselves! That an animal so unsociable to its fellows should not merely tolerate but desire human society is very singular. Most singular it must seem since our domestic cat has been less modified by civilisation than most tame animals, and if circumstances require, can resume her place in the wilderness with more ease than any other tame species. Another peculiar circumstance is that several nearly allied forms, including the wild cat of Britain, seem hitherto utterly untameable though certainly belonging to the same type as *Felis domestica.*

We do not know whether it will be considered a blameworthy digression, but it seems to us and to not a few other observers that the moral character of the cat has altered for the better, and is still altering within say the last century. There are few persons now given to studying closely the habits of animals who would join in those sweeping charges of treachery, selfishness, and ill-temper which were brought against her by earlier writers. Perhaps she has been maligned because of her unwillingness or incapacity to be an accomplice in human vices and follies.

* J. A. ALLEN. History of the American Bison, p. 585.

Mr. Swainson, before pronouncing the dog the rasorial type of the *Feræ* (*Carnivora*), might have done well to inquire whether this animal is an original and unitary species at all or rather an artificial blend of several wild Canidæ. It might also be asked whether some of these Canidæ, especially *Cuon dukhuensis* and *C. primævus*, have not as good a right as the domestic dog to be considered as a "rasorial type" of the Carnivora? Yet they show none of the same attachment to man which the common dog exhibits; and though they have been occasionally employed in hunting, no dependence can be placed upon them.

There is another carnivorous animal which has never been introduced into Europe, but which in India and China has been for thousands of years a trusted household friend of man, and which for combatting the serpents and other dangerous vermin of hot climates is much more useful than either the dog or the cat. We refer to the so-called ichneumon and mungus (*Herpestes ichneumon* and *H. griseus*), which are two species alike in their habits. One of these creatures is often in India left to guard a sleeping infant in the absence of the mother, and will destroy any snake, scorpion, centipede, &c., which dares to approach. Yet this docile, intelligent, and faithful creature belongs to a group approaching very closely in structure and habits to the Felidæ, and having semi-retractile claws.

Another and quite different attempt at generalisation is conveyed in the assertion that all domestic animals are naturally gregarious. In the majority of instances, both among birds and mammals, this is decidedly true, the cat and the mungus (?) being the only exceptions. But we cannot affirm conversely that all gregarious animals have entered into domestication. The wolf, zebra, the different species of baboons, the hyænas, and various other forms might here be named.

A further very curious observation is, that all the truly domesticated species, both of birds and mammals, are polygamous, or at least promiscuous in their amours. We have here the only point of difference in habits between the ordinary tameable inmates of the farmyard and the pheasants. The common cock, the turkey, the guinea-fowl are feathered Mormonites, whilst the pheasant adheres to one mate. Among mammalia the case is quite similar. The ox, the sheep, the goat, the horse are all polygamous, whilst the cat and the dog form no permanent connections, the nurture and defence of the young being left to the female alone. On the other hand the fox, which lives in pairs, has

not become domesticated, and the same may be said of the majority of the monkeys.

But here, also, the attempted rule breaks down on further scrutiny. The pigeon and the various species of parrots are monogamous; yet the former lives contentedly in a state of tameness, and shows a certain degree of attachment to man. Parrots, if kindly treated and not startled by sudden noises and abrupt movements, must rank among the most docile and affectionate of creatures, and have been known to die of grief if separated from their owner. This is the more striking as in their case domestication is the result of a single life-time. We have not been able in Europe to have either the African grey parrot, or *Chrysotis amazonica*, breeding in captivity. This result could doubtless be obtained in a hot climate, and it would be very interesting to note to what extent such birds would acquire the use of human language.

Another exception is of a different character: the gorilla is said to be polygamous, yet he has hitherto resisted all attempts at domestication.

Having thus set aside all these attempts at finding a law for the tameability of animals, we submit that the truth is much simpler than any of them. Any species can be tamed if the attempt is made judiciously and with sufficient perseverance. But in a majority of cases many generations must pass before the original wild nature is permanently and completely subverted by use, that second nature. It is curious that this view was put forward by St. James,* and was doubtless the opinion current in his time.

Whether in any given case the attempt to tame a species is made in a proper manner depends on such a number of considerations that the total result may, in common speech, be termed accidental.

We have yet to point out that there are at least three different grades in what is called the domestication of animals; or, in other words, the degree of relation into which they enter with man. In the lowest grade we find creatures which seek his near neighbourhood, not for the sake of plundering him, as do sparrows, mice, and rats, but for safety. Such are the stork, the swallow, and the martin, the rook, &c. Many more harmless and useful species of birds would enter into this class if nest-robbing, shooting, and trapping were put under a due restraint.

In the second grade come those species which are the

* Epistle III., v. 7.

property of men and which display a certain kind of docility, but which do not enter into companionship with man. Here we have all kinds of poultry, cattle, &c. The horse, if kindly treated, may pass into the third grade.

In this highest class the intimacy is closer. The animal is not merely the chattel but the companion and friend of its owner. Here we have only the dog, the cat, the mungus, the parrot, and a few song-birds.

It is a curious fact, first pointed out, we believe, by Mr. Bartlett, of the Zoological Gardens, that no ruminant animal can be admitted into this class. Pet lambs, kids, calves, fawns, &c., invariably grow vicious as they reach maturity, and have to be consigned to the butcher.

IV. THE CREMATION QUESTION.

By Frank Fernseed.

THERE are still many persons living who can remember the London graveyards, worse far than any Augean stable of old. They can tell us how Dr. George Walker, single-handed, grappled with this monstrous evil, and how, in the very teeth of misrepresentation, calumny, official and parliamentary obstruction, and, worst of all, public apathy, he finally triumphed. They can also perhaps tell us by what legerdemain his claims as the father of modern sanitation have been ignored, and the honours rightfully his have been transferred to others.

But the very same question which called forth the energies of "Churchyard Walker," as he was familiarly called forty years ago, is offering itself afresh to us of the present generation.

Out fathers closed the City churchyards, and laid out burial-grounds in what were then open districts, though at an accessible distance from London. For a time all went on satisfactorily, and many worthy people thought, and possibly still think, that the disposal of the dead was finally settled. But London since the formation of the cemeteries, whether proprietary or parochial, has continued to grow, and these once retired and rural spots are rapidly becoming

suburban, and almost urban. Abney Park, Nunhead, Highgate, Kensal Green are now populous regions, and even Finchley sees the speculative builder approaching nearer and nearer to its vast extent of graves. It is therefore plain that the resting-places of the dead will perhaps, even by the end of the present century, be closely surrounded by the dwellings of the living. We shall thus have a repetition of the evils which Dr. Walker devoted his life to banish. True these cemeteries, as far as I understand, can never be so overcrowded as were the old churchyards. Men will not be seen under cover of the night conveying away loads of half-decomposed humanity, and shooting it into the Thames. A grave, when once it has received its stipulated number, will not be reopened to make way for fresh interments; nor will the distance from grave to grave be reduced. But in spite of these redeeming features the new cemeteries will differ from the old churchyards in degree, but not in kind. Many of them are situate on eminences. Their drainage must and will find its way through the soil to houses built on the lower grounds in their vicinity. Such drainage, containing both septic poisons and disease-germs, must either permeate the soil or find its way into the system of sewers. Neither alternative is pleasant to contemplate. In the former case the ground will be poisoned, and the ground-air also. This ground-air, as Prof. von Pettenkofer has so clearly shown, passes up into our houses according to the changes of barometric pressure and the fluctuations of moisture and of temperature.

If we suppose that such drainage is entirely conveyed into the sewers, the final result is little different, since the water-closets, sinks, &c., all traps notwithstanding, give the sewer-gas access to our houses.

Nor does the air escape pollution from the immense mass of animal matter which is decomposing around us. If we take the population of London at four millions, and estimate the average life of a generation at thirty years, and the mean weight of a human corpse at 56 lbs., we reach the startling result that year by year 3000 tons of animal matter is placed to putrefy in the neighbourhood of the metropolis. Much of this matter contains the germs of smallpox, diphtheria, fevers, occasionally cholera, and other communicable diseases. This, surely, is a serious consideration. How long a lapse of time is required to convert this deadly matter into harmless mould I cannot make bold to say; but we are I think warranted in supposing that fully ten years must pass over before the buried bodies can cease to be a peril.

Hence, at any given moment, we have around us not merely 3000, but 30,000 tons of dangerous matter.

Some authorities, indeed, contend that the superstratum of earth is a sure safeguard against the escape of any harmful matter from the putrefying corpse below. Whilst fully admitting the great absorbing and purifying quality of the soil, I can see here no pledge of absolute safety. I have in more than one of our cemeteries, in calm weather, detected an unholy smell, though were I to give full particulars I should doubtless find to my cost that "the greater the truth the greater the libel." I have recognised the same unpleasant odour in dull, damp, autumnal evenings, even outside the fences. But, what is much more to the purpose, M. Pasteur, in the course of his prolonged and admirable researches on the propagation of zymotic disease, has noticed that sheep, grazing on ground where victims of the cattle-plague had been buried, became infected. He suggests that earth-worms bring up the morbific matter to the surface. When once there it may easily be disseminated by those ubiquitous *colporteurs* of disease, the flies. M. Pasteur proposes that cattle which have died of anthrax should be buried not in clayey ground, but in calcareous soils, where earth-worms are rare. Unfortunately such soils are scarce in Middlesex.

But to return: if the bodies of oxen, buried beneath 1½ or 2 yards of clay, may still impart disease to creatures feeding or resting on the surface of the ground, there is good reason to fear that human remains will be in like manner hurtful. We have therefore no shadow of reason for expecting that the neighbourhood of our cemeteries, when once fairly "built in," will be healthy.

What, then, are we to do? We cannot set bounds to the spread of London, or enact that no house shall be built within a given distance of the cemeteries. If we did so decree our task would be endless, for the abodes of the dead, like the dwellings of the living, constantly require extension. If houses do not come to the cemetery, it will come to the houses.

Indeed, if we leave the prospect of nuisance entirely on one side, we shall find here, in the mere necessity for the constant enlargement of our burial-grounds, a difficulty of no trifling weight. Can we, as a nation, afford to withdraw a constantly increasing portion of our most valuable lands *for ever* from all remunerative purposes? We are justly dissatisfied when we see acres of land covered with the "spoil-banks" of the coal-owner, the slag-mounds of the iron-master,

or the vat-waste of the alkali manufacturer. We forget that the cemetery—though less unsightly than the plots of land to which I have been referring—is, like them, simply a place for depositing refuse-matter,—a refuse, too, which modern sentiment forbids us to think of utilising. Such notions have not always prevailed, or there would be no space on the earth available. But I believe if a burial-ground had been in disuse for five centuries its restoration to agricultural purposes would be regarded by many as "desecration." Few persons reflect what will be the appearance of the neighbourhood of London in another century. By that time, if no fundamental change occurs, burial-room will have been found and provided for more than twelve million human bodies!

Some will advise to meet both the sanitary difficulty and the lack of space by going further afield. They would establish gigantic cemeteries at a distance of 20 or 30 miles from the great city, and convey the dead to their long home by railway. There are not a few grave objections to this proposal, for even greater distances from London the land along the principal lines of railway has become populous and valuable. Sufficiently large vacant spaces could not readily be found without incommoding the rural towns and villages. The expense of funerals, which already proves a sore burden to the wage class and to no small portion of the middle classes, would be notably increased. And in case of infectious diseases, what could be more dangerous and more reprehensible than to take the dead to a busy railway-station? All such schemes as special lines of rail, or even special dead-trains and funeral-stations, would not merely still more enhance the cost of interment, but would involve a shock to the feelings of all concerned. The funeral train, with its cargo of (say) fifty coffins and as many accompanying parties of mourners, steaming out into the country, would have about it nothing of the poetry of grief. Let us picture the unloading scene at the terminus!

From whatever point of view we regard the disposal of the dead, a total change of our existing system is pressed upon us. We cannot continue in our present track. It is surely well to look the only alternative boldly in the face, and consider what objections can be urged against cremation —the disposal of the dead by fire.

The most serious argument that can be offered is, perhaps, that cremation would give a prospect of impunity to poisoners by annihilating the only decisive evidence of their crime. But this difficulty would be overcome by an expedient which

is being forced upon public attention on quite other grounds. Our present system of ascertaining and certifying the causes of death is, in the opinion of the coroners of two of the most important provincial cities, far too lax. Were cremation established, in every suspicious case the proper examination would be made at once, and the results would be far more decisive than those obtained from the autopsy and the analysis of an exhumed corpse.

The second argument is one of a sanitary nature. It has been contended that the destruction of so large a mass of organic matter as the human body, by fire, could not be effected without the emission of fumes certainly loathsome and probably dangerous. This objection is entertained only by such as have a totally wrong notion of the arrangements to be employed. True, if we lay a human body upon a heap of coal or wood, and then apply fire, we shall have a scene revolting to our feelings and sickening to the senses. A variety of volatile products, such as Dippel's animal oil, will be given off, and it will be only after a very prolonged roasting that the charred remains will be reduced to their ultimate state—a pinkish white ash. But if the corpse is at once exposed to the heat of a Siemens gas furnace the offensive products of combustion are instantly decomposed into their simple elements; there is no smell and no blackening, but the rapid production of the white ash. It must be confessed that the nitrogen of the body escapes in a free state, and is consequently of no more value from an agricultural point of view. But if we allow animal matter to putrefy, whether above ground or below its surface, a great part of its nitrogen escapes in the same inert condition. Of one thing we may feel absolutely certain—that disease-germs, ptomaines, and any other morbid matter, will have been exposed to temperatures not far below a white-heat, and infallibly destroyed. Under no circumstances, then, can the corpse prove injurious after it has once been introduced into the incinerator.

We may turn now to the economical phase of the question. Will the cost of cremation exceed or equal that of interment? Let us remember that the cost of the present system is threefold. There is a first charge, borne by the entire community of a town or a parish, in purchasing, fencing, laying out a cemetery, and keeping it in order. Then there are the charges which fall upon the family of the deceased. Lastly, comes the loss to the nation, by the withdrawal of a certain quantity of the land from remunerative purposes.

The first and third of these items will be minimised by the introduction of cremation. A couple of incineration-

furnaces, in a small spot of ground decently enclosed, will suffice for the wants of a populous parish. The expenses to the representatives of the dead would be heavy if an incinerator had to be erected specially for a single corpse. But in case of the general use of cremation, as far as I can learn, they would fall below that of an interment. The purchase of the grave, the outlay for the coffin and for the tombstone, would be saved, and against these would come the simple item of fire. The ashes of the deceased might be preserved in an urn, which could be had for a few shillings, and which might find its place in the house of the relatives.

I have now to deal with two objections of a sentimental nature. I am very far from desiring to treat them on that account with contempt, though I must regard them as mainly the outcome of misconception and prejudice.

The many, of all ranks in life, feel disagreeably startled when they hear it proposed to dispose of the dead by fire. They forget that the most refined and cultivated nations of classical antiquity saw nothing revolting in consigning the remains of the departed not to the grave, but to the funeral pile. They forget, equally, the nature of the changes which take place after death. The corpse for some hours, or even days, after life has ceased appears sunk merely in a placid sleep, and may even look more lovely than in life. Fancy paints this state continuing after interment, and the mass of us speak of the dead still "sleeping" in their graves. Nay, popular tradition invests the dead with a kind of dreamy half-consciousness. But could those who muse over the sleeper follow him for even a week after the coffin has been lowered into its cell, they would see that the process is not sleep, but destruction—a destruction as complete as that which ensues during cremation, but more tedious, and passing through loathly intermediate stages which in cremation are absent. Could we but once shake off the prejudices which have overgrown the European mind for more than a thousand years, we should soon be able to idealise the pyre which restores man to the elements, and the funeral urn which receives his ashes. Poetry would find in them themes no less touching than it has found in the tomb and its fancied sleep, or in the churchyard.

The last objection is of a religious, or pseudo-religious, origin. Greece and Rome were, in their proudest and brightest days, what we call "heathen" nations, and they practised cremation. The Jews buried their dead, and, as we have derived from among them our national religion, we have come to speak of "Christian burial," and to brand

cremation as "heathenish." Some writers and speakers—not, perhaps, the most enlightened men of the day—have even gone so far as to declare that those whose bodies are thus disposed of forfeit their prospect of a resurrection! A modern scientific traveller, whose works were not long ago reviewed in the "Journal of Science," takes occasion to say that cremation might be well enough for heathen nations, but that we have higher notions of the dignity of the human body. I for one must take leave to say that I see no remarkable dignity in putrefaction. It is, further, well known that the Greeks and Romans were far more attentive to the strength, the beauty, and especially the cleanliness of the human body, than are nineteen out of twenty of the inhabitants of modern Europe.

It is known that cremation is gaining ground in Italy and in Germany. In two recent cases it has been carried out in England without any attempt at official interference. But I am told that the practice is of doubtful legality. It has further been pointed out that the fanatics in whom England is so rich may quite conceivably demand its formal prohibition by statute. Such a demand, if made on behalf of a numerous organisation, would scarcely be resisted by either of the great political parties. It is therefore highly important that the friends of the only rational and practical method of disposal of the dead should be prepared, and take the necessary steps to obtain legislative sanction for cremation at the option of a deceased person or of his friends.

V. THE GERM THEORY AND ITS LATEST CONQUEST.*

IT cannot fail to have struck most thoughtful persons that a combined and systematic atack is being made upon the medical profession, and through it upon medical science itself. Poets, novelists, ethicists, ochlogogues have formed a most incongruous alliance with the Anti-

* The Germ Theory of Phthisis Verified. By W. THOMSON, F.R.C.S. Melbourne: Sands and McDougall.

Vaccinationists and the Bestiarians. Differing in everything else, they fraternise on the broad principle of hostility to medical research and medical practice. It is asserted that the art of healing has no fixed principles,—that it passes from one extreme to another, swayed by fashion rather than reason, and that any improvements are effected not by the spontaneous action of the faculty, but are forced upon it by the pressure of public opinion.

It may, of course, be asked—What concern is this of ours? We are not, and do not in any way profess to be, an organ of the medical profession; but we see very clearly that if medical science and its practitioners are brought into contempt, all science—and more especially biological science—must suffer. Seeing, therefore, our neighbour's house on fire, we do not consider ourselves bound to remain inactive. On this principle we have defended physiological experimentation for medical purposes, well knowing that in proportion as it is imperilled similar experimentation conducted in the interests of pure biology will be in equal, if not in greater, danger. That for so doing we can be rightly charged with hypocrisy we cannot admit, or even conceive.

Much attention has been for years past drawn to "germs." We find the word used not merely in medical or in scientific circles, but among the general public, and sometimes without any very clear notion of its real meaning. Nor has ridicule been wanting. For centuries we have heard it read in our churches that "A little leaven leaveneth the whole lump." For centuries we have seen fermentations, putrefactions, decompositions, and transformations of various sorts take place, as well in the living body as in dead organic matter, and in substancces which never have lived. But when we are told that these changes, or at least many of them, are induced by "germs," we find it a theme for laughter—asinine rather than Olympian. The British public has never seen a germ, never handled one. A germ is nothing quotable on the Stock Exchange or at Mincing Lane—nothing upon which an impassioned harangue may be delivered in Parliament or at Exeter Hall. And therefore, forsooth, it is a thing to be laughed over—a mere "Hirngespinst"; and those who talk about germs are merely gulling the public, and seeking to hide their own ignorance, Q. E. D.!

Such is substantially the style in which the "germ theory" of certain diseases and of fermentations is talked of by too many of the respectable and intelligent whose sweet voices go to make up public opinion.

At the risk of some hard words we must endeavour to combat this kind of opinion, and to show the world that germs are in no sense to be laughed at, but that an insight into their nature and their actions would conduce greatly to our well-being.

What, then, is a germ? A microscopic being, in some cases of animal, but more commonly of vegetable nature. More strictly speaking, a germ is the egg or seed of such minute creatures. These germs are suspended in the air, scattered over the earth, over vegetation, and over animals, being in fact almost omnipresent. Such germs differ in their nature, and accordingly they produce very different effects. If one of them falls into any suitable liquid,—be it blood, milk, grape juice, &c.,—or upon any solid organic matter, such as the flesh of a dead animal, it becomes developed, and reproduces its like with great rapidity. In so doing it effects most important changes in the matter which it inhabits. Thus suppose we crush a quantity of grapes, and leave their juice exposed to the air, in a short time the juice undergoes that change which is known as alcoholic fermentation. The sugar present in the juice is decomposed, forming carbonic acid, which escapes, and alcohol, which remains in the liquid; this change is effected by a minute plant, a *Saccharomyces*. In its absence neither wine, beer, nor any alcoholic liquid can originate fermentation, as has been experimentally proved. Under certain conditions, further, if wine or beer is exposed to the air, we know that it passes into vinegar. This is the action of a "germ" of another kind. In a precisely similar manner the putrefaction of milk, of flesh, &c., is occasioned by other "germs." If these are absolutely excluded, as in a tin of Australian meat, no putrefaction sets in, and the meat may be preserved for an indefinite time. We may easily learn that it is not the previous boiling which keeps the meat from entering into decomposition, for if we make a small hole into such a tin, so as to admit the air, the meat in a short time becomes offensive. It might be argued that the air itself, independent of any germs which it may convey, occasions fermentation and putrefaction; but this supposition is at once overthrown by the fact that if air is admitted which has been passed, *e.g.*, over red-hot asbestos or pumice-stone in a glass tube, or which has been filtered through cotton-wool, no fermentation or putrefaction arises. On this subject the beautiful experiments of M. Pasteur and of Prof. Tyndall may be regarded as conclusive.

But certain germs are capable, under favourable circum-

stances, of setting up changes in living animals and plants. They are drawn into the lungs with the breath; they enter the stomach with the food; and in these organs, or in the blood, they set up changes which may be likened to fermentation. That in this manner fevers, cholera, smallpox, &c., are propagated in man, pébrine in silkworms, "charbon" in cattle, may be considered proved beyond all doubt.

We know it has been asked why, if such be the case, are not all persons attacked by fevers, &c.? The answer is, firstly, that the "germs" of those diseases are not equally present either in time or space. During the epidemics of cholera or plague a very large part of the persons in the districts affected, sometimes even a majority, are attacked. Again, climatal and seasonal conditions vary: the germs of yellow fever do not seem capable of reproducing themselves in the British Islands, whilst those of smallpox, diphtheria,* and scarlet fever find no difficulty in crossing the Arctic circle. Lastly must be considered the personal element. Some men have evidently a greater power of resistance than have others. If exposed to infection they take the disease slightly, or not at all. The case is precisely similar with ordinary fermentation. The brewer seeks to have his worts always in the same condition, and to effect the fermentation in one unvarying manner; yet sometimes in spite of all his tact and experience, aided by all the resources of modern science, a brewing fails. Need we then wonder if, in the vastly more complex field within which disease germs act, the results should vary?

A certain writer whose works we lately noticed, and who is disposed to be very severe on our medical men, and upon the "germ-theory" as the fashion of the day, thinks that rinderpest and other cattle diseases would disappear if cattle were kept under better sanitary conditions. Unfortunately it has sometimes happened that cows were attacked on model farms, where every care was taken for ventilation, drainage, cleanliness, and pure water, whilst the disease passed harmlessly over others which were housed and kept in the filthiest and most slovenly manner.

But we must hurry on to our more immediate subject. Phthisis—or, as it is commonly called, consumption—is of all diseases the commonest and the most hopeless. That it carries off about one-third of our adult population, or rather of those who have reached the age of puberty, is admitted.

* During the past month diphtheria has been very severe in the Loffoden Islands.

That the number of complete undoubted recoveries is exceedingly small no one will deny; so small, indeed, as to permit a doubt whether in such cases the disease had been rightly diagnosed.

Now till lately the cause of this havoc, though much discussed, was unknown. Popular tradition in some districts pronounced consumption "catching," but the notion was generally treated as an old wives' fable. Curiously this view seems to have been most generally entertained on the coasts of the Mediterranean, and especially in Southern Italy.

A favourite delusion has been to connect consumption with climate. It was supposed to be endemic in England, and any warmer climate free from extreme temperatures was recommended. Hence consumptive patients, in the beginning of their sufferings, were sent off to the Undercliff of the Isle of Wight, to places on the south coast of Devon, to Cannes, Nice, Algiers, Naples, Madeira, Australia, or the Cape. In the same way American consumptives repaired to Florida or the West Indies. But the fatal truth by degrees came out that consumption prevails alike in hot and cold regions, on the sea-level or on lofty table-lands, in dry or in moist air. In Australia phthisis is substantially as fatal as in England, and carries off more of the black aborigines than does any other malady. Consumption, in short, is not derived from "taking cold," though, where existing, it may be aggravated by a cold.

Nor can it be said that in-door sedentary occupations and over-crowding are *in themselves* the cause of the mischief. Neither yet can it be deficient food or insufficient clothing.

That in the absence of any knowledge as to the cause of the disease no rational system of treatment could be devised needs no proof. So matters stood; consumption being most emphatically the *opprobrium medicinæ*.

The author of the little work before us seems to have been the first who threw light upon the question. In a pamphlet published in July, 1876, entitled "The Histo-Chemistry and Pathology of Tubercle," he asserts the parasitic origin of phthisis. He puts the question, "How would specific Micrococci operate as the proximate cause of the equally specific morbid process of general tuberculosis?" In answer to his question he wrote—"I therefore venture to think they will probably be found to operate as the exciting, efficient, or, better, proximate cause—the *materies morbi* of tubercle." He minutely explains the mode of action of the parasitic germ in producing that aggregation of cells forming a tubercle, which is first grey and then yellow. He says:—

"In this mass of epithelial *débris* the minute bodies of the microzymes are set embalmed, or buried, as it were, in the ruins they have produced." Mr. Thomson justly calls attention to the analogy between this sentence and the following passage from a later work of Dr. Koch, the head of the German sanitary department. This eminent authority writes:—"It is in the highest degree impressive to observe in the centre of the tubercle-cell the minute organism which had created it."

Mr. Thomson also showed in his first work that the occasional aggravations of the fever, cough, and other symptoms of consumption, are due to the development of a fresh crop or generation of the parasitic germs.

These ideas of the authors have been since abundantly verified by observation and—if in these good days we may venture to speak of such a thing—by direct experiment upon animals. Inoculation with tubercular matter has produced tubercular disease. The attention of the faculty and of the public being thus turned in the right direction, evidence of the infectious nature of consumption became multiplied. The author gives some very striking cases. Here we find, for instance, that a strong robust man marries a "delicate" (we hate the word) wife, who soon died of phthisis. The man soon fell off in health, and is now in the second stage of acute consumption. An active healthy young man leaves Melbourne for a holiday trip to the old country. On his return voyage he occupies a narrow cabin with a phthisical invalid in active disease. Not long after returning home he too was attacked. But for further cases we must refer to the author's work.

It is a trite saying that a true theory may soon be known by the ease with which it lends itself to facts. This is eminently the case with Mr. Thomson's views. Consumption is always said to be most fatal among persons who live, work, or sleep in narrow confined rooms. If it is infectious this is precisely what we should expect. Such persons will be far more likely to inhale the deadly matter than if their occupation were in the open air.

Again, phthisis is hereditary, and runs in families. True, and what is more probable than that the child should receive the infection from its mother, and the sister from the brother?

Are we justified in regarding the discovery of Mr. Thomson as a great triumph, sufficient in itself to demand a retractation of the rash censures which have been uttered against medical science? Emphatically, yes! Knowing

that consumption is transmissible from one person to another, we shall at least know how to prevent or greatly to limit its propagagation. Henceforth intermarriage with a phthisical person will be not only a physical sin, endangering the health of possible children, but a case of constructive suicide. Can none of our ethical writers, so concerned about virtue and happiness, see their way to enforcing this truth? Again, it will become not merely policy, but duty, on the part of those who live in the same house with a consumptive patient, to take jealous care not to contract, and ultimately to propagate, the disease. No one should share the bed, or even the bed-room, of the patient; the bed- and body-linen should not be washed along with those of other persons, and should, after washing, be stoved with sulphur, or be taken through a solution of sodium bisulphite, slightly acidulated with hydrochloric acid. The matter expectorated, which is the chief source of danger, should be received in spittoons charged with some powerful disinfectant,—say carbolic sulphite; the contents should be emptied not into the dust-bin, but into the fire. As far as possible people should, when travelling in public conveyances, avoid sitting next to or opposite to any person who has a cough. Tram-cars and railway carriages are bad enough, but the greatest danger is in the inside of an omnibus, where the passengers on opposite sides are brought so unpleasantly near to each other.

Neither Mr. Thomson nor any of the distinguished physicians who have since verified and extended his discovery have been, as yet, able to lay down a definite process for the treatment of consumption. But the profession know now, at least, in what direction to look. The remedy must be a "germicide,"—a destroyer of the lower and more minute forms of life. It is fortunate, we may here remark, that the Microzymes or Bacilli, which occasion both fevers and phthisis, are pronounced by high authorities to be of vegetable nature. Were they animals we should perhaps find "Zoo-folly" protesting on their behalf. Some sage would make the notable discovery that they "have equal rights" with ourelves, which "are in no case to be hastily and unfairly set aside." Perhaps the day may come when a license from the Secretary of State will be needed before a physician dare administer an anthelmintic medicine to his patient. But the germs of phthisis being, as we have said, plants, have no "rights," and may be dealt with at pleasure.

It is a sad but curious fact that Mr. Thomson has earned small thanks in Melbourne by his discovery. We do not,

indeed, learn that the Australians treat phthisis as a vested interest to be reverently conserved on ethical grounds, as some of the "unco guid" do at home with another disease which is secretly undermining the vigour of the race; but they regarded it as a libel to be told that the Australian climate was no antidote for or safeguard against consumption, and that natives of Australia, black or white, were as liable to this scourge as if they had been born in Britain. For seeking to arouse his neighbours from this delusion the author has been proclaimed a fanatic and a firebrand. A premier of Victoria actually asked him—"What are our young people to die from, since they may not die from typhoid fever or phthisis?" Surely he was a typical specimen of the men whom we "Anglo-Saxons" at home or in the Colonies set to rule over us!

VI. THE HEADS OF GREAT MEN, AND THEIR OCCURRENCE.

By D. Yewdall Cliff.

DR. GILBERT, Physician to Queen Elizabeth, so famous for his researches in magnetism, was, it is said, the first to suggest that men of great intellectual powers have large and massive heads. This conclusion is as commonly accepted as it is agreeable to ourselves in theory; but if before deciding we take a review, by means of the busts, pictures,* photographs, &c., of the world's most famous celebrities, the opinion most certainly is not universally borne out by facts. I have noted in earlier paintings that men are distinguished by this trait, showing that the painters had, perhaps, also the same notion. In Mr. Wallace's "Australasia" there are as fine heads, of savages, as ever civilisation has produced, apparently in the pure native. The remark of a wise Englishman, "If perseverance is not genius, it is something very like it," may therefore not unlikely be true.

* *See* Art Journals; Cassell's, Ward and Lock's, Macmillan's, &c., publications; The Graphic, Illustrated London News, &c.

I have not had the opportunity of going deeply into the matter, but I believe that often it is the father who has the massive head and large brain, a fact which seems in some way to cause the brain of his offspring to be of that nature which produces a genius; but I do not like to venture far on this ground. Compare, for instance, the two Skobeleffs, the Russian generals; if the "Graphic" sketch be correct the father has a far superior head to his more famous and talented son, lately deceased. Compare Bismarck and his father (not very fine), the first two Peels, &c.

There is also another curious item, which I do not ever remember seeing noticed,—all the great men of ancient and modern times have noses arched outwardly, the bridge not being depressed. Perhaps Socrates is an exception. Cyrus (of Persia) is said to have had a very peculiar nose, and Napoleon is reported to have declined to make a general of a man faulty in this respect.

A receding forehead is generally condemned; nevertheless this feature is found in Alexander the Great, and to a small extent in Cæsar; also in the Sphinx (1400 B.C.), which must have embodied the Egyptian ideal of perfection; in Savonarola, of Italy, and in our own James Watt.

Other great men have positively small heads; that of Lord Byron was "remarkably small," also those of Cosmo di Medici and Lord Bacon.

Many men of genius of ancient times have only what may be called an "ordinary" or every day forehead; for instance, Herodotus, Alcibiades, Euripides, Plato, Aristotle, Sophocles, Escliades, Epicurus, Severus, Lucius Verus, &c. And among the moderns, Swift, Goldsmith, Otway, Bunyan, Calvin, Erasmus, Luther, Linnæus, Rembrandt, Ariosto, Johnson, Molière, Chaucer, Wedgwood, Caxton, Moore, &c. Many are of a medium size, as Rameses II., Homer (reputed bust), Æschylus, Demosthenes, Augustus, Leonardi da Vinci, Otto III., Cervantes, Loyola, Richelieu and Mazarine (fine), Addison, Chatham (Pitt), Crompton (male), Cartwright (loom), Moritz Retzch, Watteau, &c.

Those that are remarkably fine and massive do not constitute the majority: we may mention Eschines, Cicero, Hippocrates, C. Scipio, Melancthon, P. Corneilli, Rabelais, Roger Ascham, Defoe, Rennie, "the" Felton, Fulton, Julius II. (Pope), Galileo, Crabbe, Shakspeare, Hannibal, Boccaccio, Voltaire, Shelley, Wordsworth, &c.

Then, again, some are even low-browed, as Robert Burton ("melancholy"), W. Kalf (painter), Diogenes, Sir Thomas Brown (forehead "remarkably low and depressed")—

"Macmillan" (s. xxvii.,); monarchs in plenty — Nero, Caracalla, Trajan, Louis XIII., &c.; and Albert Durer, Raphael, Luther, Arkwright (spinning-frame), Alexander, Miltiades, &c. This is, of course, relying on what portraits we have,—a necessarily imperfect source, but sufficient to give weight to my assertion.

This study of the head is extremely interesting, and it is significant that the literary patricians of Rome used to place the bust of an author amongst his own works, the group being incomplete unless the man was seen.

But to take up another subject. The literary and historical student cannot fail to notice how rarely the same name re-occurs in history, &c., particularly where a family connection can be traced; and when it does happen it is either very remote or quite immediate, as father and son, &c. It would seem as if a race gradually came to a climax in some genius, greater or smaller, and dwindled off again, either dying out or beginning again to improve after a relapse. It is noticed amongst some carnation growers that many of these plants seem to have a "constitution" which carries a new seedling through a certain number of years, and then it dies out, no matter how largely it has been split up by layering, &c. But be this so or not, it is, I think, evident that this is a fact with the human species, individually and racially.

Are there two Aquinases, two Dantes, Ariostos, Tassos, Machiavellis, Racines, Cervantes, two Chaucers, Marlows, Spensers, Shakespeares, Miltons, Blakes, Congreves, Newtons, Pepys (!), Shelleys, Lockes, Gibbons, &c.? No. Each race originated in some happy marriage, &c., culminated,—and was not.

But there are exceptions: there were two Cromwells, equally great geniuses in their day; but then other families must have had their influence through marriage.

And there are a few others: some may appeal to a line of kings, our own for instance. We cannot consider everything for want of room and interest. The Saxon line was the longest that ever reigned in England, beginning with Cedric (519—1042), giving us sixteen kings in the direct male line from Egbert to Edward the Confessor. The Plantagenets rank next (1154—1399), which line gave in direct male descent twelve kings.

Let us consider the individual kings who may claim the rank of genius, recollecting that such a race has the very best possible earthly chance. From the conquering Cedric to Egbert is three hundred years. Ina—who is famous for

his code of laws—is the only intervening king worthy of notice. Egbert cannot be classed high; accident, not conquest, made him "king of the English." Alfred is the genius of his race; besides him ranks only Athelstan, the conqueror of Scotland and the "Emperor of Britain." Of the House of Anjou, Henry II., Edward I. and III., and Henry V. are worthy of mention: of these Henry V., and perhaps Edward I., may claim the rank of genius. The House of Tudor was probably best sustained (1484—1603); Elizabeth was the genius. William the Norman might claim to be the genius of his line, but we can hardly rank a Stuart (in England) amongst this class. Finally comes the line of Brunswick, which has yet its genius to produce: it has ample opportunity. We have no king as yet who will stand in the first rank—with Napoleon, Charlemagne, Cæsar, &c.

But to return: it often happens that near relations have eminent abilities, but not of the first rank: for instance, the Zuingles of Switzerland, the two Vanes, Hamilcar, Hannibal, the Medici; Sir W. Davenant claimed to be Shakespeare's son; the Colmans (father and son), Coleridges (father and children), Fletchers (P. and G., brothers), Corneilles (brothers), Fieldings (brother and sister), Sheridans (mother and son), &c.

We often find the same name recur, but are unable to trace a family connection, which probably never existed. Such persons, it must be noted, are as a rule very wide apart. Thus there are the two Butlers,—authors respectively of the "Analogy" and of "Hudibras,"—the two yet more famous Bacons, and a host of less prominent instances, Moores and Mores, Sidneys, Smiths, Taylors, Tindals, Whites, Harringtons, and Greens.

If we take a wider survey of man we find history not merely repeating itself, but presenting its parallelisms. Let us bear in mind Mr. Pfoundes's researches on the development of old Japan, and compare it with the history of European countries with which that island empire had in those days no connection.

According to Mr. Pfoundes the feudal system was introduced, perfected, and completed there at the same time as in Europe. Hallam fixes its culminating point for Europe in the eleventh century. It was the same in Japan. Japan destroyed her convents and disbanded her monks within about a century after the time of Henry VIII.

M. E. Renan, in his "Life of Jesus," makes the following interesting observation, which bears exactly on this point:—"The history of the human mind is full of strange coinci-

dences, which cause very remote portions of the human species, without any communication with each other, to arrive at the same time at identical ideas and imaginations. In the 13th century the Latins, Greeks, Syrians, Jews, and the Mussulmans adopted scholasticism, and very nearly the same scholasticisms from York to Samarcand; in the 14th century everyone in Italy, Persia, and India yielded to the taste for mystical allegory; in the 16th art was developed in a very similar manner, in Italy, at Mt. Athos, and at the Court of the Great Moguls, without St. Thomas, Barhebræus, the Rabbis of Narbonne, or the Motécallémin of Bagdad having known each other, without Dante and Petrarch having seen any Sofi, without any pupil of the school of Perouse or of Florence having been at Delhi."

It is interesting to notice the average foreheads of the Greek sculptures as seen in the friezes from the Parthenon, in the British Museum. They are, if anything, lower than the average seen in modern foreheads. About this fact there can be no mistake, which is significant if we suppose that the Greek artist would reproduce the average types prevailing among his countrymen. The gods themselves are represented with ordinary, if not low, brows. This might be intelligible in Bacchus and Herakles, but not in Apollo and Zeus. Many of the groups also display what we should call short, squat figures, though the gods are figured with finely proportioned limbs. Probably many reflections which might here arise escape us from their very nearness.

VII. DETECTION BY ELECTRICITY OF THE ANNUAL CULMINATIONS OF THE SOLAR INFLUENCE ON ORGANISMS.*

By Nils Kolkin.

IT came to my notice, several years ago, that if one end of a hair or thread were tied to a watch-key, or some similar object, and a person, seated comfortably before a table, with his elbow resting on the same, took hold of the

* Read at the Montreal Meeting of the American Association for the Advancement of Science.

other end, so as to raise the key from the table and keep it suspended, it was impossible to keep it still, in spite of all precautions. Oscillations would begin which, if the hands were warm, would attain great violence. If the key were permitted to strike against anything except glass, silk, dry rusty iron, or other bad conductors of electricity, the oscillations would be interrupted by short pauses occurring at regular intervals; and the strokes between these pauses would correspond with the age of the hair, or, more correctly, their number would show how many years old the person was when he lost it. I understood that these oscillations were caused by electricity; that the key was positively or negatively charged and repelled by the arm and hand, which were similarly charged.

I have since investigated this phenomenon, as much as my time has allowed, and I shall here carefully give the results of my experiments. I have also substituted electricity from other sources than that used in those primitive experiments, and when I have not met the same success it is due to the fact that I am not a practical electrician.

There is no known principle that accounts for the pauses in the oscillations. But the explanation seems to be that—When any organic substance is continually charged by positive or negative electricity, and discharged in rapid succession, under certain circumstances, the substance itself, and things in contact with it, will, after a certain number of discharges, for a moment become non-conductors; and the number of those discharges will correspond to the age of the vegetable or animal from which the substance is derived. I say "under certain circumstances," for I do not know whether repulsion and attraction is necessary or not. My experiments have always been with a suspended key, except with a metallic spring, placed horizontally, which is virtually the same thing. The resistance to electricity during the pause is, indeed, very slight; it does not take a very powerful charge to overcome it. The weaker the supply of electricity the better it is. Shortening the fibre by which the key is suspended will give the best results. It will make the oscillations more rapid, and they ought to be rapid enough to make it necessary to count them by twos, for the pause will thus be better noticed.

All organic substances possess this age-telling property, except absolute non-conductors, as silk. If substances of different ages are used together, the age of the oldest only is shown. This fact makes it possible to find the age of substances of all forms, even with a suspended key. A fibre

of an annual plant may be used, and any dry substance tied in it: in case of liquids, the fibre may be saturated with them. Liquids are good conductors, and must be guarded against. The smallest particle of juice, or sweat, on anything, when of higher age, will show its presence.

The age of a substance here must not be taken to mean the time it has existed as such, but that age which the vegetable or animal that may be its source had when its connection with that source was severed. A leaf may be two months old, but it shows the age of the tree; a drop of milk, that of the cow. I have permitted myself to call this "organic age;" but as we have nothing to do with any other kind here the word "age" must always be taken in this sense. Any part of an organism—any seed, fruit, secretion, or any part of product whatever—has the same organic age as its source. The age of vegetables counts from the time they sprang from seed. Those propagated from roots or cuttings have the age as the original. A potato showed between 800 and 900 years. The age of animals corresponds with what is commonly termed so; but new-born young have the same organic age as the mother.

This age-telling property of organisms does not seem to be destroyed by time. To what extent chemical change does it I cannot say. Considerably decayed wood retains it. Some kerosene, which caused the discovery of the age-telling property of liquids, showed constantly eight years: but this might have been due to some foreign substance.

It is, of course, plain to all that the interruption of the oscillations has nothing to do with our civil year as it is divided off in the almanac, but with a natural year. A natural year in our zone consists of an increase, a culmination, and a decrease of the solar influence. It is the number of those annual culminations to which an organism has been exposed during life that is shown. In case of annual plants, grown during the increase or decrease, they will show a year though they have not been exposed to the maximum influence of the sun. So with animals less than a year old. The oscillations generally cease very abruptly, but when a considerable fraction of a year remains uncounted there is often a gradual subsidence into a pause. How it is with organisms under the equator, where the sun passes twice a year, I do not know. But a knowledge of it would throw some light on this question.

That the sun has great influence on plants all know; but

that it should have so great an influence on animals that each annual increase, culmination, and decrease of that influence should be registered in their organisms will seem to many a great heresy. The sun, however, has more power than is generally supposed. Many persons will know that they do not feel the same under its decrease and increase. They do not seem to be the same persons in the autumn and in the spring, everything else being equal. The influence of the sun pervades all Nature, and reaches life, both animal and vegetable, in recesses completely hidden from its rays.

VIII. NOTE ON PINK OR ALBINO CARP.

By A. Anthony Nesbit, F.C.S.

In order to ascertain whether the change in the colour of carp effected by light, mentioned in the "Journal of Science" for June, was due to change of shade in an existing pigment, or whether light acting on the epidermis manufactured an entirely new pigment, two albino or pink carp were taken, and one placed in a plain glass globe, the other in one of the same size coloured dark blue, and both placed in the same degree of light. After three weeks' exposure the fish were placed in separate clear glass globes, and compared and pronounced by three independent observers to be practically unaltered.

This fact appears to indicate that light merely modifies an existing pigment which is absent in the pink or albino fish, and which it is powerless to manufacture.

IX. THE ACTION OF POISONS ON THE PETALS OF FLOWERS.

By A. Anthony Nesbit, F.C.S.

I. *The Alkaloids.*

IT having come under my notice that a flower placed in water into which some tobacco had accidentally fallen faded with surprising rapidity, I resolved to make some experiments on the action of various substances on the life of flowers, and for this purpose selected some of the best-known alkaloids, *viz.*, strychnine, solanine, digitaline, quinidine, atropine, quinine, cinchonine, picrotoxine, aconitine, brucine, and morphine, using ¼ per cent and 1 per cent solutions. The alkaloid of tobacco being very difficult to obtain pure, owing to its rapid oxidation, 5 per cent and 20 per cent solutions of tobacco (bird's eye) were used in its stead. The flower chosen for experiment was the narcissus, and the results showed that there was here a wide field for long and patient investigation.

Of all the twelve solutions tobacco proved, in a very marked manner, to be most destructive to the life of the flower of the narcissus; the remaining eleven poisons, though but slowly injurious, nevertheless in some instances showed marked difference of effect, or, it may be said, symptom. Thus strychnine, next in poisonous power to tobacco, drew the petals upwards, and made them dry and brittle, symptoms also exhibited by solanine poisoning, while quinidine and several other alkaloids rendered the petals limp and rotten. Morphine, one of the least poisonous (to the narcissus) of the alkaloids experimented with, without destroying the flower, curiously enough imparted to the petals a flaccidity resembling that of the petals of the poppy.

(To be continued.)

ANALYSES OF BOOKS.

Chapters on Evolution. By ANDREW WILSON, M.D., F.R.S.E., F.L.S., &c. London: Chatto and Windus.

THE object of this work, as declared by the author himself, is "to present, in a popular and readily understood form, the chief evidences of the evolution of living beings." To some extent, therefore, it covers the same ground as a work by Mr. Romanes which we had the pleasure of noticing in our October issue. Dr. Wilson, however, takes a wider scope, and at the same time enters more into the details of the evidences for the New Natural History, and his work is necessarily of greater extent. In the opening chapter he calls attention to a distinction commonly overlooked by gainsayers and outsiders. "Darwinism," he shows, is not synonymous with Evolutionism, but is "to be regarded merely as one, but also as probably the strongest, phase of those speculative endeavours to show the 'how' of living nature." In this same chapter a consideration is put forward which, though taken from Mr. Herbert Spencer, is not as widely known as it deserves to be. Early ideas, whether belonging to the childhood of the individual or to that of the race, are not usually true ideas. We have been compelled to reject the astronomy, the physics, and the chemistry of the ancients. Why then should it be different with their biology, and especially with its leading tenet, the doctrine of special creation, or rather of special origination?* "If the interpretations of Nature given by aboriginal men were erroneous in other directions, they were most likely erroneous in this direction. It would be strange if, whilst these aboriginal men failed to reach the truth in so many cases where it is comparatively conspicuous, they yet reached the truth in a case where it is comparatively hidden." What candid thinker can help feeling the great weight of this contention?

After summarising the teachings of Darwin in a series of eight propositions, Dr. Wilson shows that the term "biology," first introduced by Lamarck, is a more precise, and therefore a preferable, name for the discipline formerly known as "Natural History." We must here, however, join George Henry Lewes in his

* We must remember that the men who uphold the fixity of species are by no means necessarily Theists. France can show abundant evidence to the contrary, especially the Positivists.

regret that "certain quacks, with customary ignorance, have vulgarised and distorted the term Biology, and applied it, in contempt of Greek and Science, to their "Mesmeric operations."

Dr. Wilson then proceeds to explain the divisions of this vast science, namely, morphology, the science of form,—comprising anatomy, development (commonly called embryology), and taxonomy or classification; secondly, physiology, the science of function,—the distribution of species in time and space, or organic geography and palæontology; and lastly, what Dr. Wilson calls the ætiology of animals and plants,—that is, the inquiry How has each species come to be what it is?

Inquirers of this last kind were a few years back "relegated to the domain of the unscientific, if not to that of the impious as well." Even now they are looked upon with very different feelings. The other day Prof. Stokes could say, at the Church Congress at Derby, "I prefer resting in the statement of a special creation without prying into its method"—an attitude which, if consistently adopted, would render all Science impossible. A contrasting and a far worthier position is taken by Dr. Martineau, who, as here quoted, says, "What, indeed, have we found by moving out along all radii into the Infinite?—that the whole is woven together in one sublime tissue of intellectual relations, geometric and physical, the realised original of which all our science is but the partial copy. That science is the crowning product and supreme expression of human reason. . . . Unless, therefore, it takes more mental faculty to construe a universe than to cause it, to read the Book of Nature than to write it, we must more than ever look upon its sublime face as the living appeal of thought to thought."

In the third chapter Dr. Wilson expounds further the constitution of the animal and plant kingdoms as bearing on the theory of descent, and gives a sketch of the primary classification of both the organic kingdoms.

Chapter IV. is devoted to protoplasm, the physical basis of life. Here the author states that "the latter substance (protoplasm) is resolvable by chemical analysis into the elements carbon, hydrogen, oxygen, and nitrogen, along with mere traces of sulphur and phosphorus." We read, further, that "Chemically, protoplasm stands as the type of a class of compounds, to which Mulder gave the name of proteine substances. . . . Of such substances common albumen, seen in white of egg, is a familiar example; and white of egg, indeed, hardly differs, save in minute chemical particulars, from proloplasm itself." Here it must be remarked that opinions differ. J. Reinke ("Botan. Zeitung," 1880, No. 48), having examined protoplasm obtained from the fruits of *Ethalium septicum*, detects in it, in addition to the elements above mentioned, calcium, magnesium, sodium, potassium, and iron. He maintains, further, that protoplasm contains scarcely 30 per cent of proteine-like matter, and that "it can no

longer be spoken of as a coagulum of white of egg." It may also be contended that the chemical identity of the protoplasm of all animals and of all plants is not proven, since it has been actually examined in very few cases only. Indeed from multitudes of forms it would be impracticable to obtain protoplasm in quantity sufficient for analysis. It must, however, be recognised that an established difference in the chemical constitution of the protoplasm obtained from different species would be a serious difficulty in the way of the Evolutionist interpretation of Nature. If all beings are descended from one common origin, it seems probable that their matter and their ultimate texture will show marks of such relation not less distinct than do their outward forms. We doubt whether, *e.g.*, the blood-elements and the spermatozoids have been sufficiently studied from this point of view in mutually allied forms.

Concerning the origin and nature of life Dr. Wilson's views may perhaps be summarised in the following extracts :—

"It is by means of protoplasm that the cells of the liver secrete bile; it is through the properties of protoplasm producing new cells that a scratch heals or other breach of bodily continuity is repaired; and it is by means of a peculiar functional development of this same substance that we are able to lay the flattering unction to our souls that we are the possessors of mind, intelligence, and will."

"Of the differences in the inherent nature of protoplasm under different conditions we are as yet in complete ignorance."

Again: "Nowhere do we find life dissociated from protoplasm, and this fact alone argues in favour of the view that the 'vital force' of the scientist or the 'vital spark' of the poet is in each case merely the convenient and summary expression of that high form of energy which corresponds to no one force in Nature, but to all combined." It might perhaps be permissible to ask for a more precise statement of the last clause.

The writer goes on to quote the following significant passage from Prof. Huxley:—A mass of living protoplasm is simply a molecular machine of great complexity, the total results of the working of which, or its vital phenomena, depend, on the one hand, upon its construction, and on the other upon the energy supplied to it; and to speak of 'vitality' as anything but the name of a series of operations is as if one should talk of the 'horology' of a clock."

After these preliminary considerations Dr. Wilson proceeds to the various evidences in support of Evolution, taking in succession those from rudimentary organs, from the tails, limbs, and lungs of animals, from the doctrine of likenesses (homology), from the missing links, from development, from the life-history of insects, from the constitution of so-called colonial or compound organisms, from the fertilisation of flowers, from degeneration, and from palæontology. All these various classes of

evidence are handled with consummate ability and with a wealth of illustration which speaks highly both for the author's wide and profound learning and for the skill with which he can bring his knowledge to bear upon the point at issue. Of especial merit is the chapter on "Missing Links." Dr. Wilson is particularly plain and emphatic in correcting an error into which even highly educated men—not to speak of gainsayers prone to the *suppressio veri*—still at times fall. He writes:—"The knowledge of what Evolution really teaches and reasonably demands constitutes the first condition for ascertaining what 'missing links' are required. To bridge over the gulf between the gorilla or any other anthropoid ape and the human type may be the life-long worry of unscientific minds contorting the demands of Evolution. It is certainly no business or labour of Mr. Darwin and his followers, or of any other school of Evolutionists. Mr. Darwin, writing in his 'Descent of Man,' and after a review of man's theoretical origin, is careful to add—'But we must not fall into the error of supposing that the early progenitor of the whole Simian stock (including man) was identical with, or even closely resembled, any existing ape or monkey.' We must, in truth, look backwards along the files of time to the point whence, from a common origin, the human and ape branches diverged each towards its own peculiar line of growth and development on the great tree of life." In another passage, protesting against the same error, he says—"Mr. Darwin's theory does not demand that the gorilla or any of his compeers should be directly connected with man. The gorilla lives, so to speak, at the top of his own branch in the great tree of life, whilst man exists at the top of another higher and entirely different bough."

Is it too much to hope that, after this plain explanation, people will no longer affect to be shocked at their supposed descent from the Anthropoids?

But Dr. Wilson shows that the absence of "missing links" in various parts of the animal kingdom is to be expected. We know that there are at present a number of very well-marked forms—commonly called breeds or races—of the domestic pigeon. Yet all these varieties are descended from one common stock,—the rock pigeon (*Columba livia*). But where are the intermediate forms connecting the pouter, the fantail, the carrier, and the tumbler with the original stock? They are not to be found, and there is no record of their existence. If, then, the absence of intermediate forms between (say) birds and reptiles is held to prove that they have not sprung from one common stock, but have had independent origins, it must follow, on the same principle, that the pouter and the fantail did not spring from the rock pigeon, but are primordially distinct, which is absurd. That, moreover, such intermediate links have been found between the birds and the reptiles, as well as between many other groups not respectively isolated, further strengthens the author's case.

Another specially important and interesting chapter is that which treats of the evidence from the constitution of compound —or, as they are technically called, "colonial"—animals. Here we encounter certain most interesting philosophical questions, to which we may return on a future occasion. The author states—"In the reproduction of the bee race certain of the eggs are impregnated or fertilised, whilst others are allowed to develop without the performance of this process, rightly deemed of essential nature to the propagation of both animals and plants. Now the eggs of a queen bee which she lays in an *unfertilised* condition invariably develop into *drones* or male bees, whilst the fertilised eggs become females or neuters."

We are bound here to point out that the Abbé Giotti Ulivi, after a prolonged course of observations on hive-bees, comes to a different conclusion. He finds that every egg that hatches into a male or female has been previously fertilised, and that parthenogenesis among bees is not proven.

The chapter on the evidences from degeneration will prove instructive reading for those—and they are many—who conceive that Evolution in the species or the individual necessarily involves an advance towards perfection, or, in other words, that change is always for the better.*

We are now, however, warned that we have already exceeded our limits. We will therefore merely add that there are two classes to whom the study of Dr. Wilson's book may be especially recommended,—to all candid doubters and gainsayers, and, on the other hand, to disciples in Evolution, that they may learn how to render a good reason for the views which they have embraced.

Metals; their Properties and Treatment. By CHARLES LOUDON BLOXAM. New Edition; partially re-written and augmented by ALFRED K. HUNTINGTON. London: Longmans and Co.

WE have here an improved edition of a work which has been favourably known to teachers and students of metallurgy. The present editor has added a somewhat extensive chapter on fuel, in which he takes into consideration wood, charcoal, peat, lignite and coal of all classes, coke, and gaseous fuel. The applications of petroleum in smelting metals are not discussed. On the utilisation of the bye-products of coke-burning, such as tar and ammonia, the author does not seem very sanguine. He considers

* The same error is committed in Sociology.

that hitherto little or no saving was effected by the preservation of these products. Should the value of the tar, &c., rise, whether from an increased demand or from a falling off in the activity of gas-works, the case may become different.

As regards another desideratum, the removal of sulphur from coke, the author considers that no satisfactory process has as yet been devised. He calls attentron to the not unfrequent presence of phosphorus in the ash of coal as a source from which this unwelcome impurity may be introduced into iron.

Under the title "Refractory Materials" a short but useful section is given, including an account of the now celebrated "basic lining of Messrs. Gilchrist and Thomas.

The author then proceeds to a consideration of the metals, their purification and their uses, *as such*, it being understood that their applications as oxides, chlorides, salts, &c., are not included in the plan of the work.

In the section on iron we find a notice of the most recent improvements, such as the Siemens-Martin process, that of Pernot, and the "basic process" of Thomas and Gilchrist. The author considers that steel will ultimately be manufactured as cheaply as iron, and that wrought iron will consequently, among civilised nations, become a thing of the past.

Under "Copper" we find the note that "Our market is now ruled by the price of Chili and Australian copper, and not by the standard fixed by the Swansea smelters, as formerly." If this means that the great copper "ring"—perhaps at one time the most powerful of similar combinations—has come to an end, all consumers of copper may be devoutly thankful.

We do not find any reference to the Hollway process for the treatment of sulphides. Phosphor-bronze is briefly referred to, but not under its usual commercial name.

The author has included even some of the less common metals in his survey, such as palladium, cadmium, magnesium, and sodium. The process for the metallurgical treatment of iridium, said to have been recently invented in America, has escaped his attention.

The work appears, as a whole, to be an excellent summary of our present knowledge in metallurgy, and as such will be duly appreciated by the numerous classes of persons concerned.

The Doomed Comet and the World's End. By J. A. Westwood Oliver. London: Wyman and Sons.

The author of this work sets out with the very laudable intention of preventing a panic being conjured up by occasion of the comet now or recently visible. He writes:—

"The present occasion offers an unusually good opportunity to the gentlemen who would fain see us all in a better world. Hitherto the fatal comet has always been going to strike our earth. This time it is to poke up the solar fires, and so cause us to be cremated where we stand. There is thus the great advantage of novelty. Then they can quote the statements of one of our ablest astronomers to bear them out. The fact that he has contradicted what he has said goes for nothing. Altogether they have the chance of making a very good case of it, and if they do not—why, they are not at all up to their business."

We may here remark that as far as England is concerned, the solar fires would bear a very considerable "poking up" before we should have cause to complain. For ten years we have had nothing worth calling a summer, and the three winters of 1878-79, 79-80, and 80-81, have been more Russian than British in their character.

To return: Mr. Oliver first examines the probability of the present comet, or, indeed, of any comet, falling into the sun. He informs us that the comet of 1843, which Professor Boss considers identical with the one now under consideration, passed within 80,000 miles of the sun's surface,—a perilous proximity. As the present comet has returned much earlier than was anticipated, it is probable that the great resistance which it must have encountered in traversing the solar "corona" must have notably shortened its orbit. If Professor Boss is right in his belief in the identity of the comets of 1840, 1880, and 1882, we may be, thinks our author, on the eve of witnessing a "curious consummation."

Next comes the question of the effect of a comet's downfall upon the sun. Sir Isaac Newton was of opinion that the comet of 1680 would fall into the sun, after some five or six revolutions. "Whenever that time shall arrive," he declared, "the heat of the sun will be raised by it to such a point that our globe will be burned, and all the animals upon it will perish." The author here remarks that Newton's opinion was based upon erroneous notions regarding the nature of the comets. He held them to be "solid, compact, fixed, and durable, like the bodies of the planets." He contends that there is no reason to believe that "the heat of the sun will be greatly augmented by the addition of the comet's heat to his own store." He gives instances where comets have passed very close to us without perceptibly increasing the heat of our atmosphere.

He next inquires how much heat will be generated, supposing a comet were to fall into the sun by the sudden conversion of its

vis vivâ? He shows that supposing the velocity of the comet to have been 300 miles per second, then every 1 lb. of its mass would liberate heat enough to raise 126 tons of water from the freezing- to the boiling-point. But what will be the weight of a comet? Here authorities differ. Sir John Herschell thought "a few pounds." The author thinks it "improbable that the whole thing has a mass much greater than a few tons," whilst Professor Pierce argues that the nucleus of the comet of 1843 must be of metallic density, and consequently that its mass must amount to thousands of tons.

The meteoric train which the "Doomed Comet"—like every other body of its class—draws after it, is estimated at 200,000,000,000,000,000,000 lbs. Were this quantity of matter suddenly plunged into the sun, the heat evolved would be sufficient to raise the temperature of a sphere of iron of the size of the earth to 1450° C. above its melting-point. Such a liberation of heat would doubtless affect the radiation of the sun. But from considerations laid down it is probable "that the comet must be swallowed up piece-meal, the whole operation occupying not years but possibly centuries."

Turn we now to a consideration of the effects of increased solar activity upon the earth. The presence of sun-spots has for more than two centuries been supposed to influence the weather. But concerning the nature of this influence the learned are not agreed. Some have held that a spotty sun portends cold and wet; whilst others maintain that it causes fruitful seasons. An increasing attention has been given to the subject since Wolf, of Berne, discovered the sun-spot cycle of eleven years, and concluded that when spots are plentiful the seasons are warm and dry, but when the sun is spotless they are cold and wet.

The author does not dispute the connection of this cycle with the occurrence of magnetic storms and auroræ. But he is sceptical as regards its influence upon hot and cold seasons, cyclones, storms and gales, wet and dry seasons, frequency of hail and thunder, earthquakes, famines, pestilence, political agitation, the sweating sickness, the potato disease, commercial crises, and shipwrecks. He reminds us that Gautier, from observations embracing Europe and America, came to a conclusion precisely opposite to that of Wolff, whilst Dr. Jelinck, from observations embracing the whole world, shows that no conclusions at all can be drawn. He remarks: "Statisticians, like the late Stanley Jevons, Mr. W. W. Hunter, and others, took it for granted that a connexion between the number of sun-spots and our meteorological conditions was established when nothing of the kind had been done. They constantly said 'meteorologists tell us' so and so, and then proceeded to argue upon the basis of Lockyer and Company's statements. Shaky foundation! Mr. Cornelius Walford's chronology of famines has effectually disposed of the famine cycle, and works of a similar nature would

soon demolish the others." He adds in a note that Mr. Walford is preparing a chronology of plagues.

In fact there is an open and palpable difficulty in the way of these cycles as far as the weather and the crops are concerned. Different parts of the same hemisphere, and even of the same continent, are differently affected. During the past summer, western Europe, as far as Italy, Switzerland, and western Germany, inclusive, has suffered from cold and wet, whilst Hungary, Russia, and the Balkan Peninsula, have basked in sunbeams, and enjoyed a harvest so bountiful that much of it has been left ungathered!

In conclusion the author expresses his belief that the British Isles and western Europe will be affected in such a way as to induce warmer and drier weather. This prophesy, as far as the British empire is concerned, is largely tempered with evil, for he goes on to say that "the opposite conditions may be expected to prevail in India, Australia, and North America."

The Mind in the Face; an Introduction to the Study of Physiognomy. By W. McDowall. London: L. N. Fowler. Edinburgh and Glasgow: Menzies and Co.

That character, ability, and all that is included under the term "mental disposition," are to some extent shown in the face, is an opinion of venerable age. Like many such opinions it contains an element of truth which deserves candid appreciation, elimination from accompanying errors, and careful culture. Hence the work before us has a legitimate object, and merits public attention. It would obviously be no small gain to the world if those peculiarities of the features in which every man differs more or less from every other man could be found to be —in mathematical phrase—*functions* of the equally endless varieties of character.

Many an upright man would find his path smoothed, and many a villain would be brought to an unexpected check in his career, if his inward nature could be even approximately read by his neighbours.

But this problem is admittedly difficult. All observers must admit that there are, on the one hand, persons whose dispositions or aptitudes—whether good or evil—are readily apparent, whilst, on the other, there are those whom we pronounce inscrutable. "What do you think of Mr. X?" "I can't make him out." Who has not heard this question and reply?

The author of the treatise before us fully admits that physiognomy is fragmentary, and that its chief exponent, Lavater,

"never aspired to the honour of building up a complete system." For such a task, indeed, he was not the man.

Mr. McDowall seems to some extent to consider that our physiognomic insights into character are based more upon "instinct" than upon reason. He writes:—"Children, though unable to reason upon the subject, are guided by it in their likes and dislikes; and we doubt not the lower domestic animals, unenlightened by Lavater, are yet guided by the science which he taught. Burns could not have made his canine friends, Luath and Cæsar, dogmatise so finely about the lords of the creation had they not been able to read the language of the human face."

Here, however, we are reminded of an error which the author, if he does not share, still does not distinctly repudiate. Many of those persons whom our contributor Frank Fernseed terms "Cynolaters," and especially certain lady-novelists of the "Ouida" school, are given to hint that dogs attach themselves to good men, and instinctively avoid bad ones. How this opinion can be for a moment upheld in face of the palpable fact that poachers, sheep-stealers, roughs, and criminals generally are on the best of terms with dogs, is hard to explain.

But in support of the "instinctive" view it may be remembered that our first impressions of the character of a stranger to whom we have just been introduced are often more trustworthy than the careful estimates which we form on prolonged observation. Especially is this the case with dislikes. Many a person has bitterly rued overruling such dislikes as uncharitable.

Mr. McDowall does not set about his task in a perfectly systematic manner. He gives the portraits of certain historical personages, and indulges in rather rhapsodical descriptions of their powers. Thus anent the first Napoleon he introduces from Victor Hugo's "Les Miserables" (Chap. XII.) a quotation extending to nearly two pages; this in a work which does not reach in all ninety pages. We have, in like manner, long dissertations on George Whitfield, on Martin Luther, on Robert Burns, and on Shakspeare. Persons of our own day, whose features might be more easily compared, if not with their characters, yet at least with their actions, are but sparingly introduced. Mrs. Fletcher and Mrs. L. N. Fowler are scarcely so well known that the public can of their own judgment compare features and character.

In addition to these ladies we find merely the Queen and Mr. Jos. Chamberlain, M.P., for Birmingham (!), neither of whom, especially the latter, can be discussed in a non-political journal. To us, at least, it is a great disappointment that the author has avoided the examination of any scientific character, whether of the past or the present. It would, to us at least, have been deeply interesting to hear his estimate of Aristoteles, of Galilei, of Harvey, Newton, or Darwin, as deduced from their portraits.

We should recommend those who have the inclination and the aptitude—including, of course, a quick eye and a good memory for forms—for physiognomic observation to apply and test the author's rules in studying the features of their acquaintances.

The Science of Home Life: a Text-Book of Domestic Economy. By W. Jerome Harrison, F.G.S. First Year's Course. London, Edinburgh, and New York: T. Nelson and Sons.

We have here the substance of lessons which have been given in the girls' schools belonging to the Birmingham School Board. The experiment of such teaching in elementary schools is, we believe, somewhat novel, and may possibly in certain quarters be looked upon with suspicion. We see no reason for any such feeling. There is nothing here but the plainest exposition of facts which every girl, and boy too, of whatever rank in life, decidedly ought to know. Unfortunately a large part even of our adult population are ignorant of much which is here set forth, and has to suffer in consequence both in the pocket and in health.

The treatise before us in some respects will remind the reader of Johnston's "Chemistry of Daily Life," and of Lewes's "Physiology of Common Life." But the information given is necessarily much more concise and simple in its form than that which is afforded by the favourite works above mentioned.

To a few passages exception may, perhaps, be taken. Thus, it is scarcely proved that diamond would result from the fusion of carbon. Nor has it ever been demonstrated that the proportion of carbonic acid contained in the air is absolutely constant and does not increase. This point, indeed, can scarcely be decided for some centuries to come.

In the paragraph on ventilation (p. 37) it would have been useful to add that air which has been breathed contains other matters besides an increased amount of watery vapour and carbonic acid. On p. 64 we read: "As the finely-divided fat passes down the small intestines it is squeezed through their sides into certain small tubes, which carry it to the blood vessels." "Squeezed" is here by no means a happy expression for the process which takes place. We find the same word used on p. 76.

Exception may, perhaps, be taken to the statement that milk is a natural beverage. It seems scarcely natural for a non-ruminant animal like man to drink a secretion elaborated for the nurture of calves. The remarks on the adulteration of milk contain an unfortunate omission. It is stated, justly, that milk is heavier than water, but the author has overlooked the equally

well-known fact that skimmed milk is heavier than new milk. Hence the lactometer is useless as a milk-test. A rogue may skim the milk and add a certain quantity of water, and yet the mixture thus obtained may give, with the lactometer, the same results as pure milk. It would be a good moral lesson if children were taught to regard the adulterating tradesman as standing precisely on the same level as the thief. A public opinion might thus be created which would demand much more efficient punishments for sophistication. Mr. Harrison might, we think, with advantage have briefly called attention to the evils resulting from the use of patent or proprietary "foods" as nutriment for children. These mixtures are grossly deficient in the blood-forming elements of food, and the amyloid matter they contain is a cheap starch, which young children are unable to digest and assimilate. Medical friends of large experience inform us that when they meet with an ill-nourished, feeble child, they generally find that it has been fed on some advertised "food" or "flour." All persons who are wise enough to see the importance of so-called little things will agree with us that if such lessons were generally instilled into the young, within a dozen years the nation would be re-modelled, and not a few grievous evils would find their end approaching.

Records of the Geological Survey of India. Vol. XV., Part 3, 1882.

This issue is mainly devoted to reports on various Indian coal deposits. We have notes on the coal of Mach in the Bolan Pass, and of Sharag, or Sharigh, between Sibi and Quetta, by W. T. Blanford, F.R.S., whose opinion concerning both localities is unfavourable.

Mr. F. R. Mallet, F.G.S., describes splendid specimens of zeolites discovered in the trappean rocks of the Bhor and Thul Ghâts, the species chiefly represented being stilbite, apophyllite, heulandite, and scolecite.

Col. C. A. McMahon, F.G.S., reports on the traps of Darang and Mandi, in the North-western Himalayas; whilst Mr. A. B. Wynne communicates a note on the connection between the Hagara and the Kashmir series.

Messrs. T. W. H. Hughes, T. D. La Touche, and R. Romanis report respectively on the coal-fields of Umaria, Darangirri, and Myanoung. The Umaria coal is of fair quality, easily accessible, and the bed being of the average thickness of 14 feet the quantity available, at the depth of 300 feet from the surface over the

3 square miles examined, is estimated at 28 million tons. At Darangirri there is, in the area of 20 square miles forming the western half of the field, an available quantity of 76 million tons. At Myanoung, in British Burma, the explorations are not complete, but there is a coal-bed of the thickness of 10 feet, and there are bituminous shales, possibly indicative of petroleum.

On the Quartzite Pebbles contained in the Drift; and on their Derivation from an Ancient Land Barrier in Central England. By W. JEROME HARRISON, F.G.S. With a Note by J. J. H. TEAL, M.A., F.G.S. (Reprinted from the "Proceedings of the Birmingham Philosophical Society," vol. iii., p. 157). Birmingham: Herald Press.

THE author describes the lithology of the pebbles in question, the fossils which they contain,—chiefly Brachiopods, Lamellibranchs, Crustacea, and Annelida, and their derivation. He shows that they are derived from the pebble-bed or conglomerate which forms the middle member of the Bunter Sandstone, or Lower Trias. He considers that the pebbles in question are among the evidences of an ancient ridge which ran across Central England, and during the Carboniferous times formed a barrier between the coal-fields of Leicestershire, Warwick, and South Stafford to the north, and those of Gloucester and Somerset to the south. This ancient land axis crops out in a line of points from the Malverns, running by the Caradoc, the Wrekin, the Lickey Hills, Dosthill, and the Hartshill Range, to Charnwood Forest. Mr. Harrison considers that this range once formed a coast line washed by the waters of the "Midland Channel," and that the pebbles have been thus rounded by marine action.

Mr. Teal, in an Appendix, discusses the microscopic structure of specimens of quartzite collected by Mr. Harrison from the Lickey Hills, Nuneaton, &c. He concludes that these quartzites were originally sandstones, which have been converted by the deposition of secondary quartz. They have certainly not originated by partial fusion.

Elementary Mechanics, or First Lessons in Natural Philosophy. By W. JEROME HARRISON, F.G.S. London: T. Nelson and Sons.

THIS little work is the substance of a series of lessons which have been delivered in the schools of the Birmingham School Board. The author's method is simplicity itself: he takes some common object, or some familiar instrument, and contrives to illustrate and enforce by its means important lessons in physics. For a more formal proceeding the pupils have scarcely the time, nor would their attention be so easily arrested. But this method is, after all, that of true Science. It has been said by a very high authority that—*e.g.*, in teaching botany—we must begin with the plants, and then refer to books to co-ordinate the knowledge which has thus been drawn direct from the fountain. The same holds good in every department of Science.

We are certainly of opinion that what England really needs, if her industrial position is to be maintained, is improvement in her system of secondary rather than of primary education. Nevertheless we believe that such teaching as the work before us aims at imparting will have a salutary effect.

American Journal of Mathematics. Published under the auspices of the Johns Hopkins University. Editor-in-Chief: J. J. SYLVESTER. Associate Editor: W. E. STORY. Vol. III., No. 4.

THIS issue contains memoirs by Mr. O. H. Mitchell on "Binomial Congruences"; on "Linkages for X^m," by F. T. Freeland; on "The Strophoids," by W. Woolsey Johnson; on the "Ratio between Sector and Triangle in the Orbit of a Celestial Body," by Ormond Stone; on "Centre of Gravity of Surface and Solid of Revolution," by E. W. Hyde; on a "Point in the Theory of Vulgar Fractions," by J. J. Sylvester; on an "Immediate Generalisation of Local Theorems in which the Generating Point divides a Variable Linear Segment in a Constant Ratio," by Samuel Roberts; on the "Expansion of $\phi(x+h)$," by A. W. Whitcom; on the "Theory of Rational Derivation in a Cubic Curve," by W. E. Story; and "Instantaneous Proof of a Theorem of Lagrange on the Divisors of the Form $Ax^2+By^2+Cz^2$, with a Postscript on the Divisors of the Functions which Multisect the Primitive Roots of Unity," by J. J. Sylvester.

CORRESPONDENCE.

*** The Editor does not hold himself responsible for statements of facts or opinions expressed in Correspondence, or in Articles bearing the signature of their respective authors.

ANCIENT "CUPS AND RINGS."

To the Editor of the Journal of Science.

SIR,—In a contribution on "Stone Circles and their Relation to Outlying Stones or Tumuli on Neighbouring Hills, &c. ("Report Brit. Assoc.," 1881, p. 697), Mr. A. S. Lewis affirms, "from an examination of eighteen stone circles in Southern Britain," it was "shown that their builders had in various ways made special reference to different points of the compass, *but most particularly to the N.E.*" This information was extremely interesting to me, as about a year ago I had, from personal observation, noticed that the grooves connecting or going forth from the cups and rings on the celebrated groups of stones near the village of Ilkley, in Yorkshire, were generally axially in this direction, *i.e.*, N.E. (*see* Whitaker's "Craven," p. 289), "probably the most important group of archaic sculptures in England." One cannot help, however, regarding these with suspicion, because the hand of one of those silly weak-minded individuals (whom it would be both a service and a pleasure to kick into the nearest asylum) has been at his sacrilegious work of desecration here, at least in one instance (shown not only by its clumsy execution, but being on a ground where the rock has only comparatively recently been split off). On the stone containing the best examples there are indications of an older set below—a suspicious circumstance. However, I feel pretty sure that they have a N.E. direction (20° N.E. ?); and perhaps the cups alone, where the rings have been obliterated by time, may be said to point in the same direction. I have seen none pointing any way but northwards.—I am, &c.,

D. Y. C.

Linnburn.

THE 'SULPHUR THEORY" OF FOGS.

To he Editor of the Journal of Science.

SIR,—The og-season having again come round, and found us practically as open to its attacks as we were ten years ago, you will perhaps permit me to ask whether the fashionable theory of its origin is well-founded? If we make careful observations we find that fogs have very well-marked local boundaries which are often found to be the same year by year. Can it be for a moment supposed that these boundaries mark out constant differences in the chemical composition of the air, sulphur being present on one side of the line and absent on the other?

Eight years ago I remember a fog which overspread all London, being as opaque in Holloway, Camden Town, Westminster, and Hackney, as in the City, I happened to be going in the afternoon to Chingford. When past Hale End the train suddenly dashed out into clear air and bright sunshine. On looking back, either to the right or left hand, the fog lay sharply cut off like a fleecy wall, and seemed to be constantly recruited by vapour which rose up like smoke from among the clods of the ploughed fields. Is it likely that sulphur was the acting cause of fog in a neighbourhood so free from houses as the country between Hale End and Chingford? Sulphur fumes cannot have been brought by the wind from London, for what little current was perceptible in the air was in the opposite direction. Had such fumes been brought, would not their influence have gradually faded away instead of being abruptly cut off?

As a somewhat similar phenomenon to the abrupt termination of fogs I may mention abrupt breaks in the clouds, which, though not constant, are very frequently observed in some particular quarter of the heavens. Years ago, when living at Gorton, a village south-east of Manchester, I very often noticed that when the sky was clouded overhead and in all other directions, there was low down, near the horizon, bright sky visible to the south-west, as if it might be over the estuary of the Dee. Such breaks seemed independent of the direction of the wind, and remained without change for hours.—I am, &c.,

SKY-GAZER.

'NUTS FOR MATERIALISTS."

To the Editor of the Journal of Science.

SIR,—In one of your contemporaries, with which you seem to be on amicable terms, I find two incidents recorded under the title above quoted. In one case a ship-owner, who had insured his vessel and cargo, dreamed that he saw it wrecked at a certain point, in consequence of the drunkenness and neglect of the captain. So convinced was he that the accident would really occur that he actually "chaffed" the underwriters about the loss which they would experience. It is added that in time the ship was actually wrecked, at the very place and under the very circumstances, represented in the owner's dream.

Now I do not dispute that such incidents, if truthfully narrated, are "nuts for the Materialist." But I submit that they are no less nuts for the Animist. We are utterly unable to understand on what principle spiritual being, if such exist, should be capable of foreseeing future events more than a material being. Can the absence of such properties as extension, weight, impenetrability, &c., confer such powers?—I am, &c.,

A LUCRETIAN.

DOCILITY AND ATTACHMENT IN A DUCK.

To the Editor of the Journal of Science.

SIR,—At Finchley there is now living a duck which is exceedingly attached to the daughter of its owner. If she goes into the garden the bird comes waddling to meet her. She takes it up in her hands, caresses it, and throws it up in the air, when it flies round and round her for several times, and then returns to her feet. Instances of personal attachment among water-fowl being rather rare, this fact may possibly be of interest to some of your readers.—I am, &c.,

H. S.

The snbjoined letter originally sent to a contemporary having been ignored, it has been forwarded to us by the writer :—

MR. DARWIN AND PROFESSOR HAECKEL.

To the Editor of ———.

Sir,—May I hope that you will not object to insert in an early No. of ——— the following respectful remonstrance and explanation with reference to your remarks of November 10th, on the letter of June 5th, 1879, written by the late Mr. Charles Darwin, in answer to Baron Mengden, as recently published by Professor Haeckel, of Jena ?

Your remarks, to which I beg to direct your attention and that of your readers, are the following :—" One scarcely knows which most to wonder at, the impertinent curiosity which elicited the letter or the bad taste which led to its publication. If we were not assured that every reader of ——— has already seen the letter, we should not now publish the correct form ; for a man's views on such matters are no concern of others unless he himself chooses to publish them."

Surely, Sir, on mature reflection you will be inclined to modify this harsh judgment, and to ascribe the letter of the Baron to far other motives than those of impertinent curiosity. The feelings which dictated his appeal to Mr. Darwin were self-evidently those of an " anxious inquirer " seeking an authoritative solution of perplexity and doubt. Natural Science—in its very inception sceptical—has necessarily the most unsettling effect on minds educated in the vulgar " Creed of Christendom " and in a belief of Supernatural Revelation. And in this Age of Unfaith or Scepticism it seems as natural and becoming to consult scientific hierophants like Mr. Darwin on matters which now constitute the burning problem, both in speculation and politics, of our epoch, as it was in the *pre-scientific* " Ages of Faith " to sit at the feet of approved Confessors of Theology. "*Nullius in verba*," &c., is no doubt the perfect canon in scientific research, but this perfection cannot with justice be expected from an immature scientific tyro in his *Lehrjahre*, being a hard-won privilege of the matured *Meisterwürde*.

I feel quite satisfied that neither Baron Mengden nor Professor Haeckel were at all actuated by the unworthy motives with which you credit them, and such I feel convinced will be the all but general verdict of impartial public opinion in their favour.

Before concluding I may, without violation of any confidence, mention that, both *viva voce* and in writing, Mr. Darwin was

much less reticent to myself than in this letter to Jena. For, in an answer to the direct question I felt myself justified, some years since, in addressing to that immortal expert in Biology, as to the bearing of his researches on the existence of an "*Anima*" or "Soul" in Man, he distinctly stated that, in his opinion, a vital or "spiritual" principle, apart from inherent somatic energy, had no more *locus standi* in the human than in the other races of the Animal Kingdom—a conclusion that seems a mere corollary of, or indeed a position tantamount with, his essential doctrine of human and bestial identity of Nature and genesis.—I am, &c.,

ROBERT LEWINS, M.D.

CHEMICAL THEORY OF APPARITIONS.

To the Editor of the Journal of Science.

SIR,—The chemico-physiological hypothesis suggested in your issue for November (p. 692), in explanation of ghost-seeing, &c., reminds me of a letter I once met with in your correspondence pages (1880, p. 279), an account of a room in which few persons could sleep without being attacked with nightmare. The letter was headed "A Difficulty to Solve." Have we not here a possible solution?—I am, &c.,

OLD SUBSCRIBER.

NOTES.

Some years ago an improvement upon the old oxy-hydrogen microscope, by Mr. John Browning ("Quarterly Journal of Science," vol. vii., p. 285) was noticed in this journal. The "Journal of the Royal Microscopical Society" for October (p. 673) contains an abstract of a paper by Dr. Hugo Schröder on "Projection Microscopes," with a description of an instrument, constructed by himself, with which it is stated a power of from 100 to 2000 can be obtained, the source of illumination being an ordinary petroleum lamp: a figure of the instrument accompanies the abstract. The perfecting of such microscopes would be a desideratum, as at present the only known mode of exhibiting magnified objects on a screen to many spectators, in a manner at all satisfactory, is by the enlargement of photographs by means of a good lantern. It is to be hoped that English and foreign opticians may be able to effect further improvements.

The same journal (p. 726) quotes Prof. C. H. Kaid ("Amer. Monthly Micro. Journ.," iii., 1882, pp. 71-2) on the advantages offered by the recent improvements in dry-plate photography to the microscopist. Of dry plates it states:—

"1. They can be kept for any length of time, and used as occasion requires.

"2. If not convenient to develope the plate at the time the exposure is made, it can be put away and developed at leisure, even after an interval of weeks.

"3. No dangerously poisonous chemicals are necessary in the developing process.

"4. They are so sensitive that the light of an ordinary kerosine lamp is amply sufficient to photograph objects with all powers not higher than ½-inch objectives. Probably a ¼-inch objective could be used by properly arranging a system of condensers."

At a meeting of the Camden (U.S.A.) Microscopical Society Mr. J. Carbutt took a negative from a spider's foot with a 2-inch objective and an exposure of 2 minutes, and from a sheep-tick with an exposure of 1¼ minutes, the shorter exposure being due to the object being much less dense and yellow.

The Netherlands Scientific Society of Haerlem offers prizes for essays on the structure of the kidneys of the Mammalia, on the peripheric nervous system of the various osseous fishes, and

for a history of the development of one or several species of the Lamellibranchiæ. The essays must be sent to the Secretary of the Society prior to January 1st, 1883.

One Roald Arentz, of the State of Connecticut, has applied for a British patent for "an invention of Cosmie, being the name for gathered energy of that force which in its normal existence eventuates gravitation."

Archdeacon Colley, of Natal, is suffering under an attack of anti-vaccinationism of the most virulent type.

The "Medical Press and Circular" gives a searching review of Mr. Lawson Tait's "Uselessness of Vivisection."

Certain correspondents of an influential Scottish paper have revived the tradition that horse-hair, thrown into water in warm weather, turns into eels.

Mr. T. K. Taplin ("Light"), writing on the subject of the "divining-rod," ventures to say that "the labouring men born and bred in any district know well the nature of the land, and where water is to be obtained." How is this possible unless mining or well-sinking operations have been carried on?

According to the "Scotsman" an electric boy is being exhibited in the Waverley Market, Edinburgh. The touch of his hand produces a sensation like that produced by an electric current, and with the tip of his tongue he can give a smart shock.

The preservative injection of Dr. Tounletti, by which animal bodies may be preserved in a fresh state for an unlimited time, has been found perfectly successful, but its composition is still a secret.

Prof. G. H. Cook, in a paper read before the American Asso. ciation for the Advancement of Science, contends that the entire Atlantic coast of North America, from the Carolinas to Greenland, is subsiding. He thinks that the same change is occurring over the whole Northern Hemisphere.

The memorial to the late Prof. Balfour has taken a double form: there will be created a Studentship of the value of £200 per annum, the holder of which is to devote his whole time to original research in biology, more especially in animal morphology, and also a fund out of which occasional money grants will be awarded to further research in the same science. This is better than a statue.

Will there be no "Darwin" Studentships, Fellowships, or Professorships founded?

MM. Dehérain and Maquenne ("Comptes Rendus") find that soils which have been heated to 248° F., or have been exposed to the vapour of chloroform, cease to reduce nitrates.

Prof. John Milne ("Geological Magazine") calls attention to the tremors and oscillations of the earth as demanding closer and more extended observation.

In the same journal the Rev. O. Fisher cites the depression of ice-loaded lands as evidence that the earth cannot be rigid from the centre to the circumference.

May not the polar flattening of the earth be due not so much to the effects of centrifugal force as to the pressure of the Arctic and Antarctic ice-caps?

It is not generally known that the late William Howitt was one of the leaders of the Bestiarian movement. He it was who first termed physiological experiments "orgies of diabolism."

M. Couty, in a communication to the Academy of Sciences, shows that curare is not merely a paralysing poison, but has in the first place a slightly convulsive action. It is also not only a peripheric poison, but to a certain degree affects the nervous centres.

The Birmingham and Midland Institute is generally supposed to be a technological and scientific organisation. To judge from the speech of its President, Mr. J. A. Froude, it would seem to be rather a political club. Or, possibly, the distinguished speaker slightly mistook his locality.

M. E. L. Trouessart ("Comptes Rendus") has observed earthworms of the common species, *Lumbricus agricola*, constructing towers exactly like those described by Darwin in his last work as being constructed by a worm of the genus *Perichæta*, which has become naturalised in the neighbourhood of Nice. The anterior part of the worm's body is generally lodged in the tower. The author's observations have been principally made at the Botanical Garden of Angers.

According to "Light" Mr. E. Gallagher, of Greenfield's Villa, Heaton Chapel, near Stockport, "has given abundant proof of his seeing persons, places, and events thousands of miles away, and of ability to foresee events with great accuracy long before their literal fulfilment."

An important deposit of coal, accompanied by beds of fine white sand, has been discovered at Bou-Saada, in Algeria.

In the department Alpes Maritimes the application of carbon disulphide along with potassium sulpho-carbonate to the phylloxerised vineyards has proved decidedly successful. The vines have not been injured.

According to M. L. F. Nilson ("Comptes Rendus") the specific gravity of pure thorium is 11·00, and its atomic weight (supposing it to be quadrivalent) 232·43.

Prof. Joseph Le Conte (California Academy of Sciences) discusses certain fossil foot-prints observed in Nevada which seem due to a biped, either a man or an anthropoid ape.

A scientific friend asks whether the phenomena known as "thought-reading" may not indicate the dawning of a novel faculty which, in the course of perhaps a hundred generations, will become too plain to be questioned?

Dr. Quinlan aptly remarks that "In Germany medical science is honoured and decorated instead of being hunted into foreign countries by Anti-Vivisection Acts."

Senhor Lopez Netto has met with a "lignified" snake (Jaracara) in the crack of a tree in Matto Grosso. The animal appears to have died in the crevice, and in the course of its decay each particle of animal matter was replaced by a particle of woody tissue deposited by the cambium. The process is thus quite analogous to that of fossilisation.

Prof. Virchow maintains that it is not the province of Science to attack faith or its objects, but it is her duty to mark and consolidate the present boundaries of knowledge.

Mr. F. A. Lucas, after careful examination, decides that there is only one species of *Mias*.

M. Felix Plateau ("Acad. Roy. de Belgique," 1882, p. 727) has made some interesting experiments on the respiration of insects. He finds no direct relation between the form of the respiratory movements of an insect and its place in our zoological classification. In all insects the vertical diameter of the body decreases during expiration. A lateral contraction is observed only in certain groups. A supposed wave-like progression of the respiratory movements is perceptible only in isolated forms of some groups. Inspiration is ordinarily much slower than expiration, the latter being often abrupt. Most insects possess merely expiratory muscles, inspiration being effected chiefly by elasticity of the tracheæ. Muscles which aid in inspiration are found not only in the Hymenoptera and the Acridiidæ, but also in the Phryganeæ. The respiratory movements are of a purely reflex character. The metathoracic ganglia are not specially respiratory centres.

According to the "Naturforscher" H.H. Erlenmeyer and Lipp have effected the synthesis of tyrosine, a compound hitherto obtained exclusively from animal matter.

Herr von Liebenburg ("Wiener Akademie") suggests that lime plays an essential part in the formation of vegetable protoplasm.

"Les Mondes" gives an account of a case of malignant tumour on the cheek of a man, produced by the bite of a large black fly which was killed in the act. The pustule was cauterised, and

the patient took internally, in twenty-four hours, 500 grms. Spanish wine, 300 grms. rum, and 200 grms. Chartreuse, without experiencing the least symptom of intoxication.

Mr. T. Taylor, in a paper read before the American Association, has experimentally proved the house-fly to be a distributor of poison-germs. (We may return to this subject.)

We are happy to welcome Prof. Pettigrew, F.R.S., as an able combatant against cram and examinationism. In an introductory lecture in physiology, at the University of St. Andrews, he is reported to have said :—"The ancients believed, and he thought rightly, that men varied as to intellectual capacity and endowment, and that it was the province of education to draw out of the man that which naturally inhered in him. The more modern —and he believed the less philosophic—view takes for granted that men vary little to begin with, and that everything might be put into them by a process of cramming. The ancients aimed at teaching men to think and judge ; the moderns had no soul above passing examinations and getting on in the world. As a physiologist, his sympathies were wholly with the ancients. The great problem of the day was how to develope and cultivate the human intellect. The two great modern schools of education were, he said, widely divergent. The one sought, by symbol and cipher, to impart to the young and inexperienced head abstract ideas and truths about men and things; the other aimed at instructing youth not by symbols and the mere names of things, but by the things themselves—these, fortunately for Science, being strewn around in prodigal profusion. The former method —the symbol teaching—leans principally upon memory, and is eminently unattractive to the young mind. It has, as a consequence, proved a comparative failure. The latter method—the object lesson method—is quite a seduction for children ; it leans less, indeed comparatively little, on memory, and provokes thought and reflection. The object lesson method expands the reason, and developes and corrects the judgment."

M. Burcq ("Comptes Rendus") shows that copper has a powerful disinfective and antiseptic action. Artisans who work with this metal enjoy an almost absolute immunity from cholera and typhoid fever.

M. Joyeux-Laffuie has carried out observations on the poison-apparatus and the poison of *Scorpio occitanus*. He finds that this poison, though less deadly than is commonly inserted, is very active. A single drop injected into the cellular tissue of a rabbit proves rapidly fatal. The same quantity suffices to kill seven or eight frogs. Fishes and mollusks are more refractory, but the Articulata are exceedingly sensitive. One-hundredth of a drop of the poison immediately kills a large crab. The poison

acts upon the nerve-centres, and produces first excitement and afterwards paralysis.

Mr. Herbert Spencer, before leaving America, is said to have pointed out very emphatically the racial degeneracy which overwork is bringing upon the American people.

The honours of the Royal Society have been thus awarded :—The Copley Medal to Prof. Cayley, F.R.S., for researches in pure mathematics ; one of the Royal Medals to Lord Rayleigh, F.R.S., for researches in physics ; the other Royal Medal to Prof. W. H. Flower, F.R.S., for discoveries in the morphology and taxonomy of the Mammalia, and in anthropology ; the Davy Medal in duplicate, to Prof. Mendelejeff and Prof. Lothar Meyer, for researches in the periodicity of atomic weights ; and the Rumford Medal to Capt. Abney, F.R.S., for researches in photography.

M. G. A. Hirn ("Comptes Rendus") combats the new theory of the sun put forward by Dr. C. W. Siemens. He shows that the return of the elements to the centre would not contribute to the continuous reproduction of the solar heat.

MM. Etard and L. Olivier ("Comptes Rendus") have conducted researches on the reduction of sulphates by species of *Beggiatoa*, *Oscillaria*, and *Ulothrix*. Plants belonging to the first-mentioned genus do not flourish in waters devoid of sulphates.

M. Feltz, in a communication to the Academy of Sciences, proves that earthworms living in a soil saturated with the infectious matter of "charbon" are capable of propagating and distributing the disease.

M. D. Klein proposes the following modification in the statement of the law of isomorphism :—Isomorphous bodies have either a like chemical composition or present a centesimal composition, differing but slightly, and always containing a group of elements common or of identical chemical functions, and forming much the greater part of their weight.

M. Pouchet has communicated to the Academy of Sciences on the evolution of the *Peridinia*, and on the peculiarities of organisation which connect them with the Noctilucæ.

A correspondent of the "Field Naturalist" calls attention to a tradition that "young robins annually kill their parents during the autumn months."

MM. J. Moursin and Schlagdenhauffen ("Comptes Rendus") have experimented on the fluids of the Sea-urchins, of the cysts of Hydatids and of the Cysticerci, and, lastly, of the Amniotic fluid. All these liquids contain a ptomaine. The fluid of the large water-vessel of *Cysticercus tenuicollis* is distinctly venomous, and when injected into the peritoneal cavity of rabbits occa-

sions death, with symptoms indicating the decomposition of the blood.

It appears that the cuckoo-cry *cui bono ?* in reference to scientific research, after being abandoned by the economists and the utilitarians, has been taken up by the ethicists. Dr. J. Burdon-Sanderson, F.R.S., justly says concerning this question—"From their point of view it does not admit of an answer; from mine it does not require one."

Our attention has been called to the subjoined passage in a somewhat heterodox journal. The writer, a lady, declares that Science, "in arriving at its conclusions and in the forth-putting of its power, is, in many instances, wantonly cruel, unscrupulously reckless, and highly immoral. In too earnest zeal, however, to overthrow ecclesiastical dogma and priestly domination, we forget that, in the vivisection of living animals, in compulsory vaccination, in imperfect drainage, in bad house construction, in the devising of monstrous instruments of war, in the snapping of cheaply-constructed bridges, in the manufacture of slipshod goods, in the use of benumbing poisons for sensual and criminal purposes, in contriving and using infernal machines, Science is working subtly and dangerously, and that the evils of unconsecrated knowledge are far more dangerous and degrading than the evils of ignorance and superstition." An author who can consider Science to blame for "imperfect drainage, bad house construction, &c.," may almost be excused for being an anti-vivisectionist. Science does not devise, construct, manufacture, or use; her sole task is to perceive, to understand, and to declare.

According to MM. Weber and Guldensteeden-Egeling ("Pflüger's Archiv.," xxviii., p. 576) a myriapod belonging to the genus *Fontaria*, found in conservatories in Holland, has the remarkable property of secreting hydrocyanic acid.

According to M. Viguier ("Revue Internat. Sciences Biolog.,") a number of carrier pigeons belonging to the Société Colombophile de la Loire were successively thrown up at Grand Croix, at Montelimart, Avignon, and Marseilles. Those which found their way back were then taken to Algiers, and thrown up there. Not one found its way back to Saint Etienne.

The Fourteenth Meeting of the Royal Commission on Technical Instruction was held on the 25th and by adjournment on the 26th of October, at the South Kensington Museum. Present —Mr. B. Samuelson, M.P., F.R.S., in the chair; Dr. Roscoe, F.R.S., and Messrs. Magnus, Slagg, M.P., Swire Smith, Woodall, M.P., and G. R. Redgrave (Secretary). The Commissioners discussed their future visits to educational institutes in this country, and made arrangements for the examination of the officials of the South Kensington Science and Art Department.

The evidence of Colonel Donnelly, the Assistant-Secretary and Director for Science, was then taken, and that of Sir P. Cunliffe Owen, K.C.M.G., the Director of the South Kensington Museum, and Prof. Huxley, F.R.S., was to follow.

At the suggestion of several friends in Cornwall Mr. Quick is about to re-publish, in one volume, by subscription, his historical and descriptive Essays on the Mining, the China Clay Trade, and the Pilchard Fisheries of Cornwall, which have from time to time appeared in the "Journal of Science," "Fraser's Magazine," and other periodicals. These Essays trace the earliest records of Cornish mining, describe the old Stannary Parliaments, deal largely with the peculiar characteristics and strange superstitions of the old miners and fishermen, and give a vast amount of other information respecting Cornish industries. Price to subscribers 4*s.* 6*d.*, which should be sent by Post-Office Order to Eastern District Post-Office, London, to Mr. Jas. Quick, 11, Agnes Street, Burdett Road, London, E.

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